
Results and
Discussion

CHAPTER IV

RESULT AND DISCUSSION

This chapter deals with the description and discussion of the result of the study. The entire descriptive analysis was done on the basis of size of land holding for meaningful presentation. Thus the whole sample was divided into four group i.e. small farmers having less than 1 ha. Semi-medium having 1-4 ha. land, medium farmers having 4-10 ha. land, and large farmers having greater than 10 ha. land. This classification is based on ICAR 2001 report.

On the whole 15.0 percent of women farmers had large size of land holding (greater than 10 hectare) and 16.664 percent of them had small land holding i.e. less than one hectare. Remaining 40.00 percent of them had semi-medium (1.4 – 4.0 hectare) and 28.33 percent of them had medium size of land holding i.e. 4.0 – 10.0 hectare.

Findings of study are introduced through composite frequency and percentage tables followed by the statistical applications for the testing of hypotheses and relevant discussion pertaining to various objectives of the investigation. Results and discussion of investigation are described under the following section.

4.1 Demographic profile and Health Problems of Women Farmers.

4.2 Body Discomfort experienced by Women Farmers.

4.3 Type of Technologies/Implements Used by Women Farmers while Performing the Various types of Activities.

4.4 Experimented Data

- Anthropometric Measurement
- Physiological Cost of Work

- Body Discomfort
- Attitude of Women Farmers towards acceptance of Modified Technologies
- Ergonomic Assessment of Technologies

4.5 Testing of hypotheses.

4.1 Demographic Profile of Women Farmers

This section of the study deals with the description of the information on personal familial and situational characteristics of women farmers. Along with supportive information from other family members. Women farmers involved in organic farming were the key respondents for the investigation.

Personal Characteristics of Women Farmers

Age, educational level and occupation of farmers comprised the personal characteristics of women farmers.

Age

The mean age of women farmers was 36.06 ± 1.94 years (Table 4.1). Age of the women farmers ranged from 20 to above 40 years out of whole sample 41.66 of women farmers belonged to the age group of 31-40 years which was classified as middle age group and 21.66 percent of them belonged to the age group of 40 and above years classified as older age group. Remaining 36.66 percent of women farmers were from age group of 20-30 years classified as younger group. Among women farmers with small landholder 40.0 percent belonged to the younger group (20-30), whereas 22.20 percent were in the category of families with large size of land holding.

Table 4.1: Personal Characteristics of Women Farmers

Personal Characteristics	Size of Land Holding				
	Small (n =20)	Semi-medium (n=48)	Medium (n=34)	Large (n=18)	Total (N=120)
1. Age (Years)					
Younger Group (20 – 30)	8 (40.0)	15 (31.25)	17 (50.00)	4 (22.22)	44 (36.66)
Middle Group (31 – 40)	10 (50.0)	22 (45.83)	11 (32.35)	7 (38.88)	50 (41.66)
Older Group (Above 40)	2 (10.0)	11 (22.91)	6 (17.64)	7 (38.89)	26 (21.66)
Mean Age SD	34.28 ± 1.57	37.97 ± 2.45	35.67 ± 1.63	36.32 ± 2.12	36.06 ± 1.94
2. Educational Level					
Illiterate	14 (70.0)	15 (31.125)	10 (29.41)	2 (11.11)	41 (34.16)
Primary School	4 (20.0)	14 (29.16)	9 (26.47)	3 (16.6)	30 (25.0)
High School	2 (10.0)	10 (14.58)	7 (20.58)	7 (38.8)	26 (21.66)
Intermediate	-	17 (14.58)	5 (14.70)	4 (22.22)	16 (13.33)
Graduate	-	2 (4.16)	3 (8.82)	2 (11.11)	7 (5.83)
3. Occupation					
Full time Farmers	20 (100.0)	46 (95.83)	33 (97.05)	15 (83.33)	114 (95.0)
Part time Farmers	- -	2 (4.16)	1 (2.94)	3 (16.66)	6 (5.00)

Figures in Parentheses indicate Percentage.

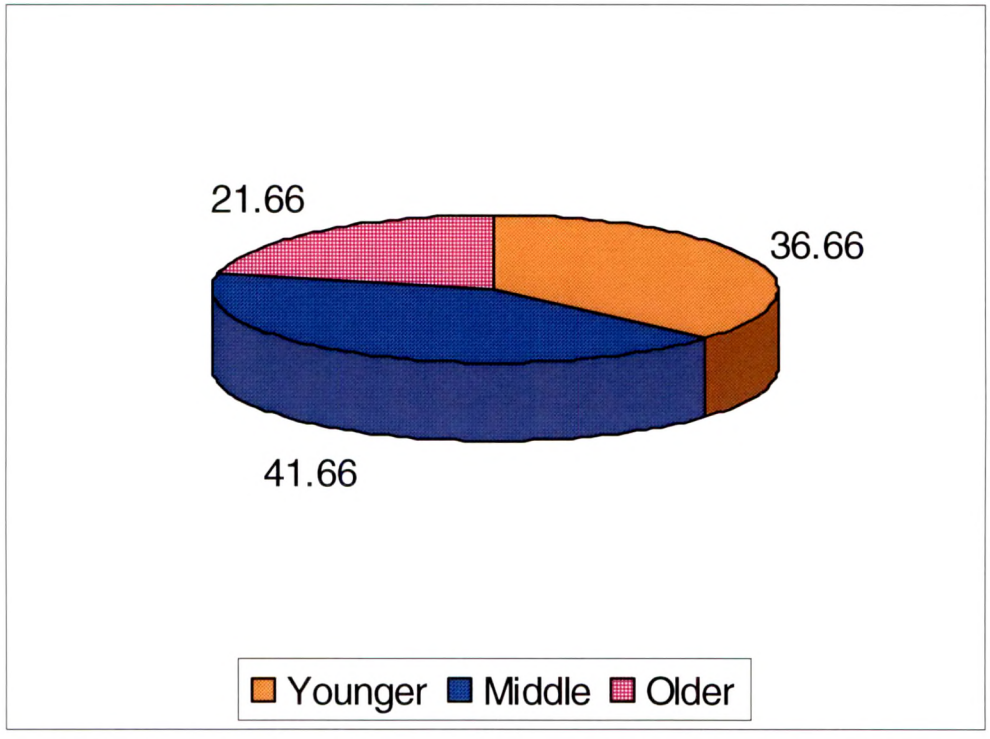


Fig 4.1 Distribution of Women Farmers According to Age Group

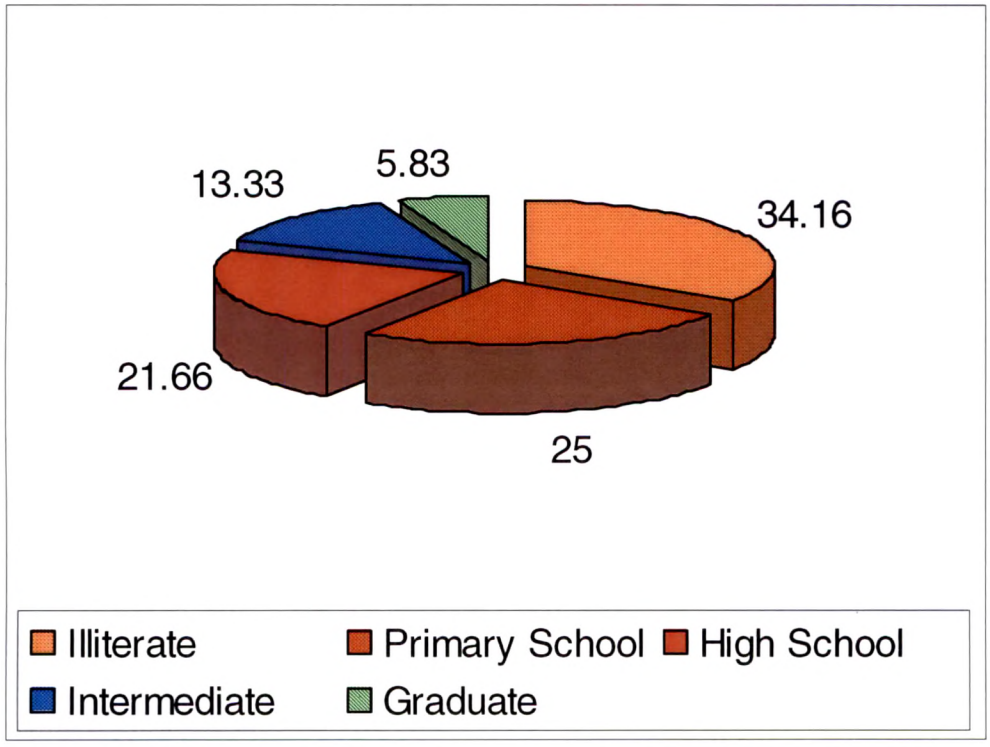


Fig 4.2 Distribution of Women Farmers According to Educational Level

Fig 4.3 Distribution of Women Farmers According to their Occupation

Educational Level

Out of the total sample 34.16 percent of women farmers were illiterate, very few of them i.e. 5.83 percent were graduate. Rest of them varied in their educational level. Among the small size land holding women farmers 70.0 percent were illiterate and very few of them i.e. 10.00 percent had education up to high school. None of them were intermediate and graduate. On the other hand, among the women farmers with large land holding 11.11 percent were illiterate and 38.8 percent were high school. Slight variation was found among semi-medium and medium farmers regarding education (Table 4.1).

Occupation of Farmers

On the whole majority of women farmers i.e. 95.0 percent were full time farmers and very few of them i.e. 5.00 percent were part time farmers. There was not much variation in nature of occupation of farmers based on size of land holding (Table 4.1).

Family Characteristics of Women Farmers

Women headed household type of family, family size, numbers of livestock or animals and total monthly income of family from all sources have been analyzed as the family characteristics of women farmers (Table 4.2).

Women Headed Household

Out of the total sample majority of women farmers i.e. 98.33 percent were male-headed household and very few of them i.e. 1.66 percent were female-headed household because they were widows.

Table 4.2: Family Characteristics of Women Farmers

Sr. No.	Family Characteristics	Size of Land Holding				
		Small (n =20)	**Semi-medium (n = 48)**	**Medium (n = 34)**	**Large (n = 18)**	**Total (N=120)**
1.	**Head of the Household**					
	Female	- -	- -	1 (2.85)	1 (5.55)	2. (1.66)
	Male	20 (10.0)	48 (100.0)	33 (97.05)	17 (94.44)	118 (98.33)
2	**Type of Family**					
	Nuclear	14 (70.0)	30 (62.5)	22 (64.70)	5 (27.77)	71 (59.16)
	Joint	6 (30.0)	18 (37.50)	12 (35.29)	13 (72.22)	49 (40.83)
3.	**Size of Family (Members)**					
	Small (< 5)	3 (15.0)	16 (33.33)	8 (23.52)	2 (11.11)	29 (24.16)
	Medium (5 – 10)	12 (60.0)	23 (47.91)	16 (47.05)	9 (50.0)	60 (50.0)
	Large(> 10)	5 (25.0)	9 (18.75)	10 (29.41)	7 (38.8)	31 (25.83)
	Mean SD	7.64 ± 0.75	5.95 ± 0.29	7.21 ± 0.71	8.89 ± 0.93	7.5 ± 0.57
4.	**Total Monthly Income of family (Rs.)**					
	Low Income Group (up to 1700)	18.0 (90.0)	17.0 (35.41)	- -	- -	35.0 (29.16)
	Middle Income Group (1701 – 4200)	2.0 (10.0)	26.0 (54.41)	25.0 (73.52)	1.0 (5.88)	54.0 (45.0)
	High Income Group (Above 4201)	- -	5.0 (10.41)	9.0 (26.47)	17.0 (94.44)	31.0 (25.83)
	Mean SD	1259.83 ± 89.16	3549.81 ± 169.34	4379.21 ± 395.20	7015.39 ± 672.41	4051.06 ± 331.52
5.	**No. of animals and livestock**					
	< 5	18 (90.0)	40 (83.33)	24 (70.58)	6 (3.33)	88.0 (73.33)
	5 - 10	2 (10.0)	7 (14.58)	9 (26.47)	10 (55.55)	28.0 (23.33)
	> 10	- -	- -	1 (2.94)	2 (11.11)	3.0 (2.5)

Figures in parentheses indicated percentage.

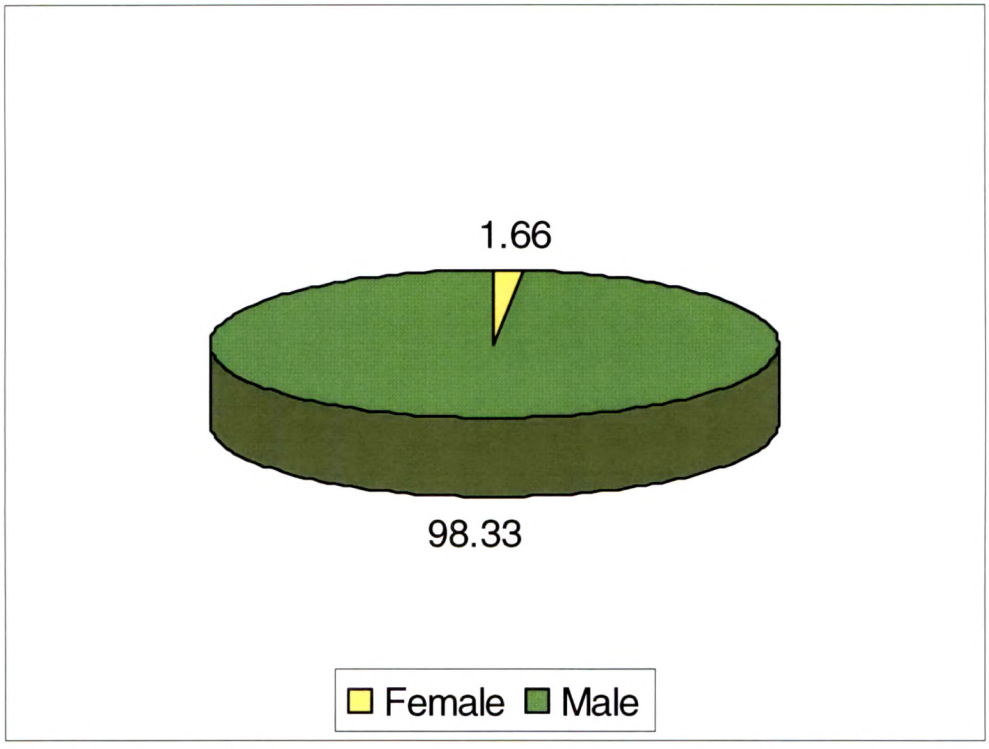


Fig. 4.4 Distribution of Women Farmers According Women Headed Household

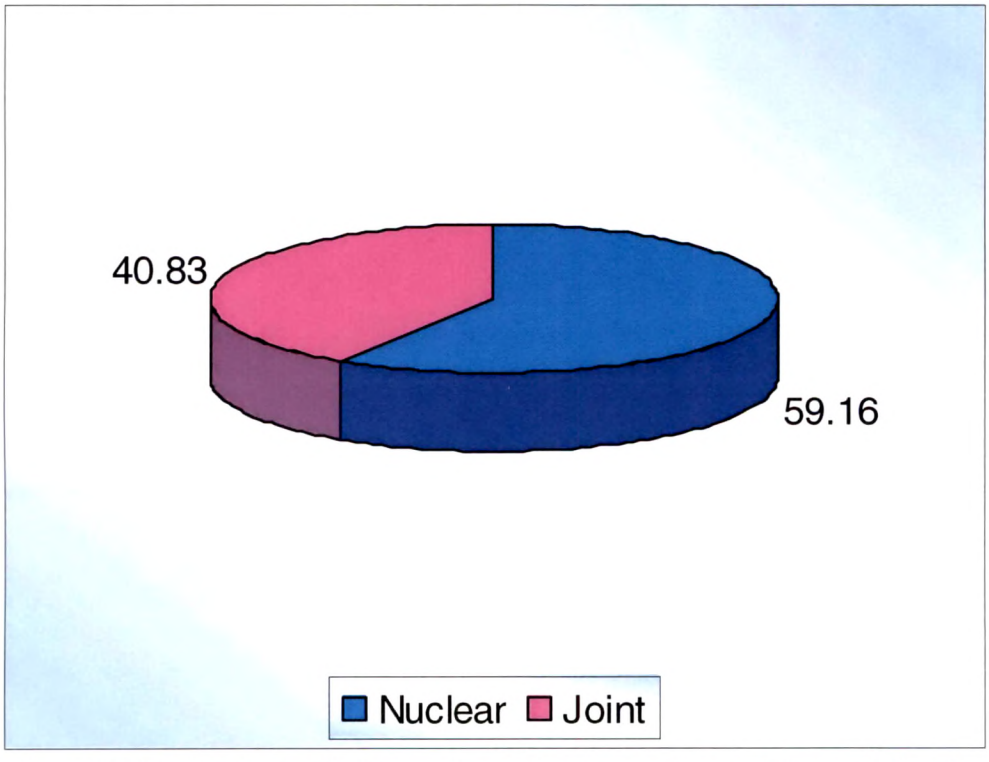


Fig 4.5 Distribution of Women Farmers According to Type of Family

Type of Family

It was found that more than half i.e. 59.16 percent of women farmers belonged to nuclear family and 40.83 percent belonged to joint-family. From the small size land-holding group 30.0 percent belonged to nuclear family. Whereas large size land holding group 72.22 percent fell under the category of joint family and rest of them i.e. 27.77 percent belonged to the nuclear family.

Thus joint family system was prominent in farmers with large land holding and nuclear family system was prominent in small and semi-medium groups of the farmers

Family Size

The mean family size of the women farmers was 7.50 ± 0.57 members. Half of the women farmers i.e. 50.0 percent in the total sample had the family size of 5 to 10 members (medium family size) and 24.16 percent of them belonged to family having less than five members (small family size). About 25.83 percent of women farmers in the total sample had a family size of more than 10 members (large family). Women farmers of small (60.00 percent), semi-medium (47.91 percent), and medium (47.05 percent) families had medium family of 5 to 10 members while the women farmers with large land holding (38.88 percent) had large family size of more than 10 members. On the whole, the data showed a trend towards medium size family.

Total Monthly Income of Family from all Sources

Mean monthly income of family was Rs. 4051.06 ± 331.52. Monthly income of family ranged from Rs. 1700 to Rs. 11500. On the whole less than half of the respondents 45.0 percent of women farmers had medium income ranging from Rs. 1701 to Rs. 4200, while 29.16 percent of them had low

income of up to Rs. 1700. Remaining 25.83 percent of them had high-income ranging from Rs. 4201 – 11500.

Majority of small women farmers i.e. 90.0 percent had low income of up to Rs. 1700. Among semi-medium farmers more than half of the respondents i.e. 54.41 had medium income of Rs. 1701 to Rs. 4200 and 10.41 percent had high income. Among medium women farmers majority of them i.e. 73.52 percent had middle income and 26.47 percent had high income. Majority of large women farmers i.e. 94.44 had high income i.e. Rs. 4201 – 11500 and very few i.e. 5.88 percent came under the middle-income group i.e.Rs. 1701 – 4200. Thus on the basis of size of land holding greater difference was observed in income of farmers. The larger the land holding the greater was the monthly income of the family.

Number of Animals or Livestock

From the total sample 73.33 percent of women farmers had less than 5 animals and only 2.5 percent of women farmers had more than 10 animals. It was observed that majority of small land holding women farmers i.e. 90.0 percent had less than 5 animals and a few large land holding women farmers i.e. 11.11 percent had more than 10 animals or livestock. Among large land holding women farmers more than half i.e. 55.55 percent had 5 to 10 animals/livestock and very few women farmers in small size land holding i.e. 10.0 percent had 8-10 animals/livestock. In semi-medium land holding group (83.33 percent) and medium land holding group (70.58 percent) had less than five animals/livestock.

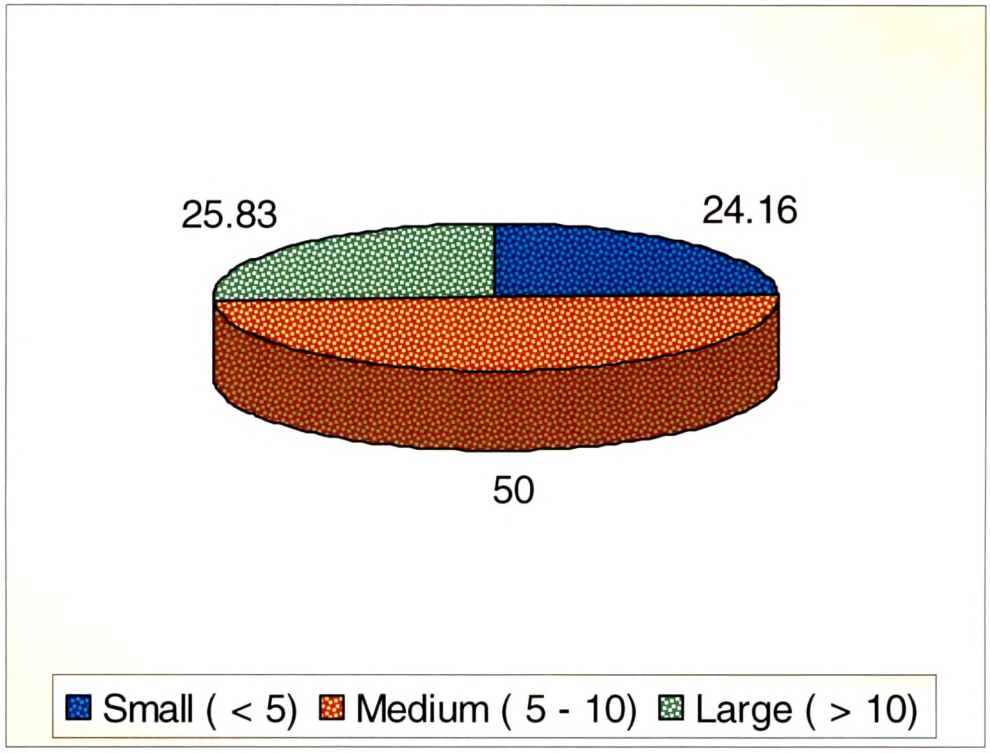


Fig 4.6 Distribution of Women Farmers According to Size of Family

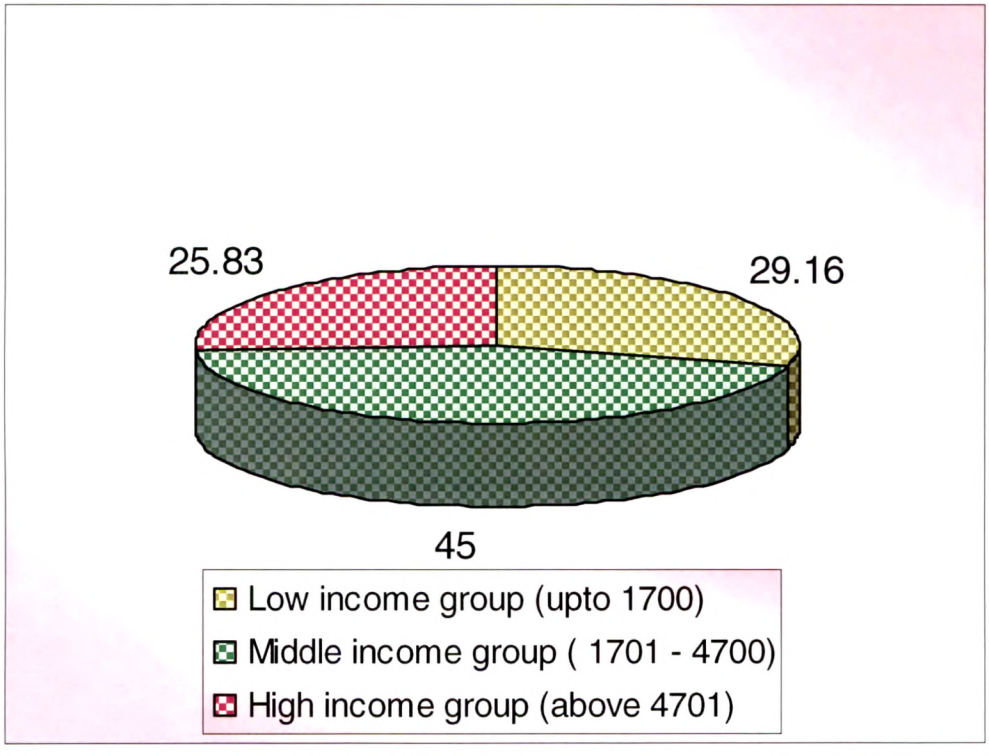


Fig 4.7 Distribution of Women Farmers According to Total Family Income

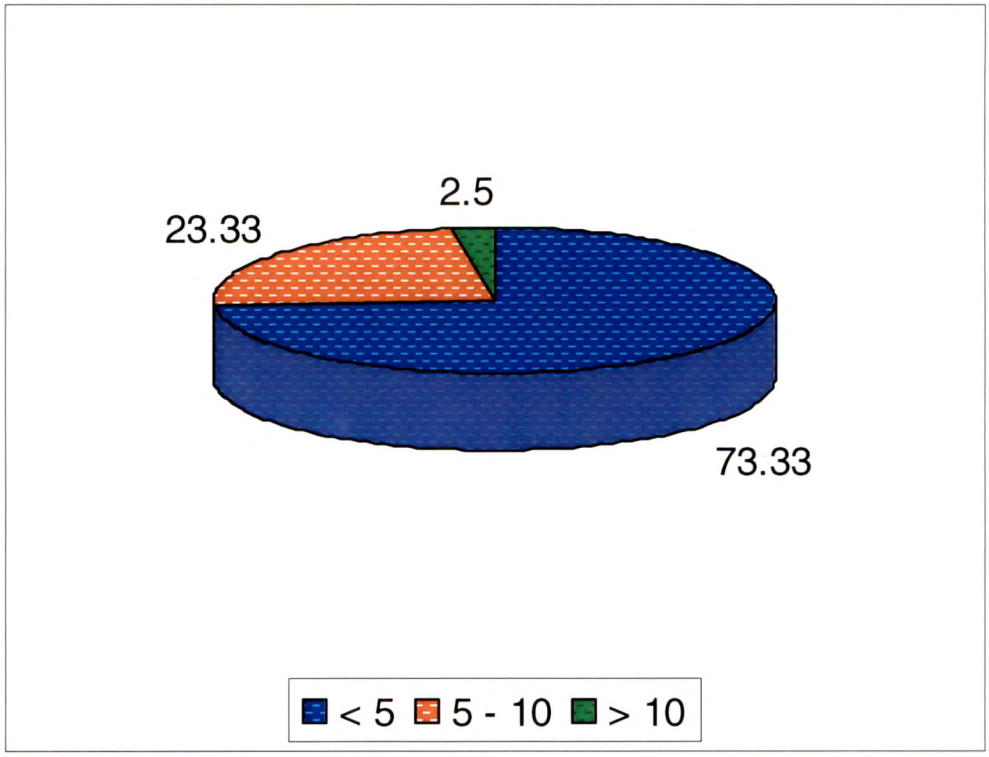


Fig 4.8 Distribution of Women Farmers According to Number of Animals and Livestock

4.2 Health Problem faced by Women Farmers

Women farmers were suffering from various types of health problems during last few years Women formers in rural areas are usually employed in monotonous and various field operations like sowing, weeding harvesting, threshing and winnowing. Due to ignorance, lack of proper care and excessive burden of household and agricultural activities, they were suffering from various types of health problems. Therefore investigator was interested in collecting in depth information regarding health problems faced by women farmers.

From Table: 4.3 it was found that none of the women farmer suffered were form diabetes these women were belonged to the large size land holding group. About 16.66 percent women farmers were suffering from hypertensions, Approximately 32.5 percent women farmers were suffering from joint pain. It was found that 10.0 percent were from the category of small size land holding group about 14.44 percent were from the category of large size land holding group. About 44.16 percent women farmers were suffering from back pain. There was slight variation on the basis of land size holding. Very few of them i.e. 1.66 percent had respiratory problems. From the total sample 5.83 percent women farmers had arthritis tendencies. About 4.16 percent women farmer belonged to the category of semi-medium size land holding group, whereas 11.11 percent were belonged to the category of large size land holding group. None of the women farmers know about the iron and calcium deficiency disorders. The back pain emerged as major health problem. It probably was due to the fact tat women workers in bending posture for long hours in various activities

Table No. 4.3 Health Problems Faced by Women Farmers.

S.N.	Health Problem	Size of Land Holding				
		Small (n=20)	Semi-medium (n=48)	Medium (n=34)	Large (n=48)	Total (N=120)
1.	Diabetes	-	-	-	-	-
2.	Hypertension	-	9 (18.75)	5 (14.70)	6 (33.33)	20 (16.66)
3	Joint Pain	2 (10.0)	17 (35.41)	11 (32.35)	9 (50.0)	39 (32.5)
4.	Back Pain	10 (50.0)	21 (43.37)	14 (41.17)	8 (44.44)	53 (44.16)
5.	Respiratory Problems	-	-	-	2 (11.11)	2 (1.66)
6.	Arthritis, Tendencies	-	2 (4.16)	3 (8.82)	2 (11.11)	7 (5.83)
7.	Iron deficiency	-	-	-	-	-
8	Calcium deficiency	-	-	-	-	-

Figures in parentheses indicated percentage.

4.3 Body Discomfort Experienced by Women Farmers in Different Organic Farming Activities

Discomfort may be defined as the body pain arising as a result of the working posture or excessive stress on muscles due to the effort included in the activity. Women in rural areas are usually employed in ordous field operation like sowing behind plough, collection and transportation of manure, digging of land, levelling of land, hoeing, weeding, harvesting, threshing and winnowing. All these operations are carried by women farmers either manually or by using tools/equipments, which were primarily developed for male farmers, as a result the output of women farmer was very low. Beside this many occupational health problem were also experienced by them. Since in Uttranchal most of the

rural women have been involved in organic farming therefore investigator was interested in collecting in depth information on body discomfort experienced by women workers. Single noun verbal rating scale for discomfort intensity (straker,et. al. 1999) was adopted. Data was collected with the help of body map. On the basis of the scale body discomfort experienced by women farmers were asked to responond on three point continum i.e. severe discomfort, moderate discomfort and mild discomfort with respective weightage of 3, 2, 1.

Body Discomfort Experienced by Women Farmer

Table 4.4 presents body discomfort experienced by women farmers in various organic farming activities. They experienced pain in following body parts.

Head

It was observed that from table 4.4 that about half women farmers i.e. 50.00 percent had headache and Among the small women farmers less than half i.e. 30.0 percent had headache. Slight variation was observed among rest of the group regarding headache.

Neck

It was found that more than half women farmers had neck pain. Rest of them had no pain in neck. From the small women farmers less than half i.e. 40.0 percent had neck pain and from the large women farmers more than half i.e. 66.66 percent had neck pain. Slight variation was observed among rest of the group regarding neck pain.

Table no. 4.4: Body Discomfort Faced by Women Farmers

Sr. No.	Body Parts	Size of Land Holding				
		Small (n=20)	Semi-Medium (n = 48)	Medium (n = 34)	Large (n = 18)	Total (N=120)
1.	Head	6 (30.0)	26 (54.16)	19 (55.88)	9 (50.0)	60 (50.0)
2.	Neck	8 (40.0)	31 (64.58)	21 (61.76)	12 (66.66)	72 (60.0)
3.	Shoulder	14 (70.0)	35 (72.91)	29 (85.29)	16 (88.88)	94 (73.33)
4.	Elbow/Forearm	15 (75.0)	40 (83.33)	26 (76.47)	16 (88.88)	97 (80.83)
5.	Palm/Wrist	12 (60.0)	29 (60.41)	30 (88.23)	13 (72.22)	84 (70.00)
6.	Back	19 (95.0)	46 (95.83)	34 (100.0)	18 (100.0)	117 (97.5)
7.	Hip/Thigh	18 (90.0)	45 (93.75)	32 (94.11)	15 (83.33)	110 (91.66)
8.	Knee	20 (100)	47 (97.91)	34 (100.0)	18 (100.0)	119 (99.16)
9.	Ankle	14 (70.0)	37 (77.08)	22 (64.70)	9 (50.0)	82 (68.33)
10.	Lumber	19.0 (95.0)	48 (100.0)	34 (100.0)	18 (100.0)	119 (99.16)
11.	Calf muscle	17 (85.0)	46 (95.83)	32.0 (94.11)	15 (83.33)	110 (91.66)
12.	Chest	6 (30.0)	23 (47.91)	17 (50.0)	10 (55.5)	56 (46.6)

Figures in parentheses indicated percentage.

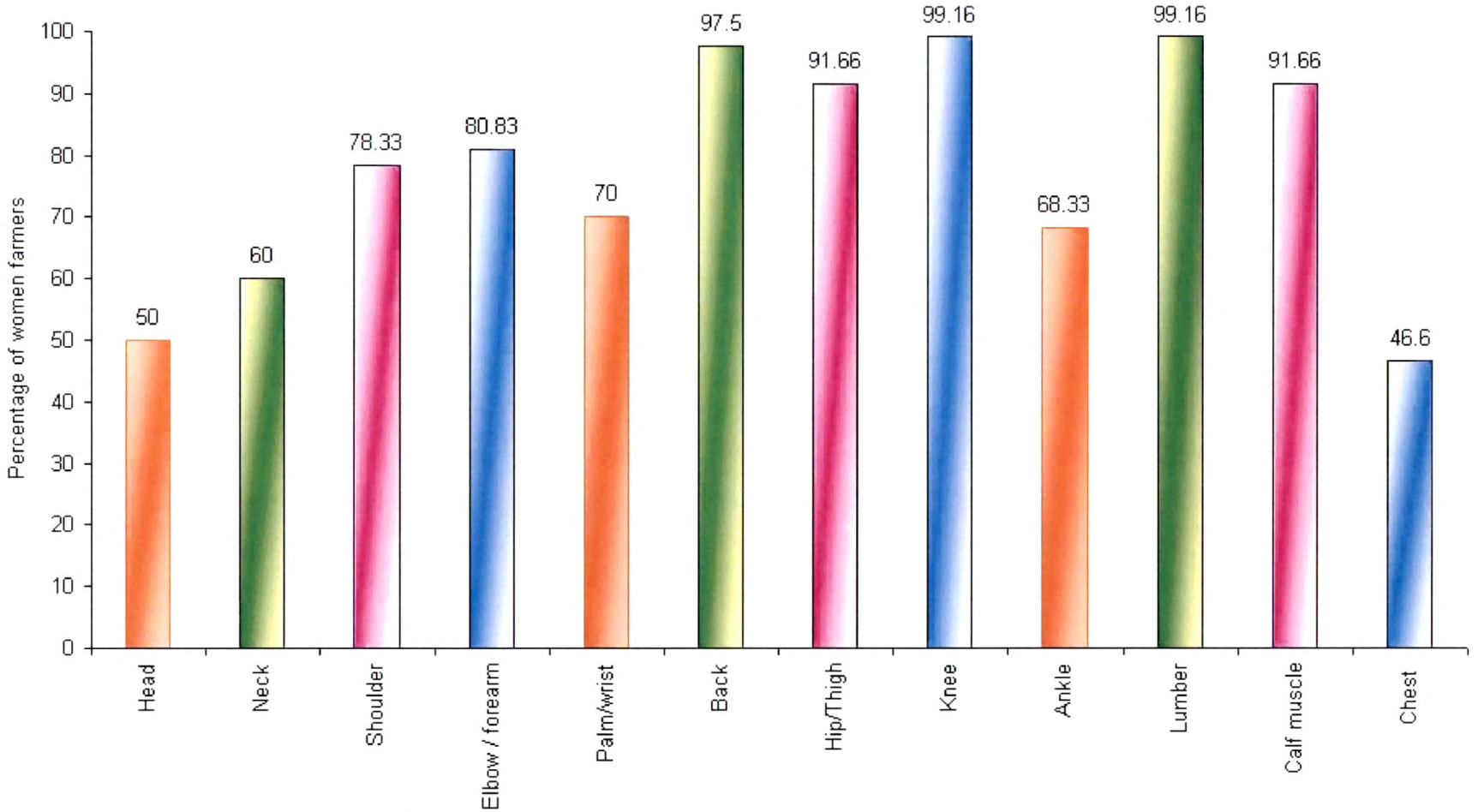


Fig. 4.9 Body Discomfort Experience by Women Farmers

Shoulder

Shoulder pain was common among women farmers On the whole 78.33 percent women farmers had shoulder pain. It was observed that among small size land holding women farmers 70.00 percent had shoulder pain. From the large size land holding women farmers 88.88 had shoulder pain, whereas slight variation was found in semi-medium and medium women farmers.

Elbow/Forearm

It was noted that majority of women farmers i.e. 80.83 percent women farmers had pain in elbow/forearm. Rest of them had no elbow/forearm pain. From the small women farmers 75.0 percent had elbow/forearm pain, whereas large women farmers i.e. 88.88 percent had elbow/forearm pain. About 83.33 percent and 76.47 percent had pain in forearm from semi-medium and medium women farmers, respectively.

Palm/Wrist

Since women farmers have been spending long hours for performing various activities like digging of land, hoeing, weeding, threshing, either manually or with help of equipments/tools. Therefore palm/wrist pain was very common.

On the whole majority of them 70.00 percent had palm/wrist pain. More than half i.e. 60.00 percent small women had palm/wrist pain, whereas 72.22 percent large women farmers had palm/wrist pain. From semi-medium and medium group women farmers had palm/wrist pain i.e. 60.41 and 88.23 percent, respectively.

Back

Out of the total sample, majority of women farmers i.e. 97.5 percent had backache due to performing various farming activities like digging of land, levelling of land, manuring, sowing, hoeing, weeding in bending or squatting

position. From the small women farmers 95 0 percent had backache, whereas all women farmers (100.0 percent) from medium women farmers had backache and 95.83 percent semi-medium women farmers had backache.

Knee

Since women farmers have been spending long hours in squatting posture during digging of land, levelling of land. Application of manure, sowing, weeding, harvesting etc. therefore, knee pain was very common among them.

On the whole majority of them i.e. 99.16 percent had knee pain and only few of them had no knee pain. Slight variation was observed on the basis of size of land holding.

Foot/Ankle

Women farmers used to walk 6 to 8 km daily for transportation of cow dung to manure shed, fetching of water, food and fodder etc. Therefore foot/ankle pain is one of the occupational health problem reported by them. It was observed that 68.83 percent women farmers had foot/ankle pain. From the small women farmers 70.00 percent had foot/ankle pain from semi-medium, medium and large women farmers respectively.

Lumber region

Since women farmers have been spending long hours for performing various activities like digging of land, howing, weeding, threshing, in various position like bending, squatting and standing-cum-bending, therefore lumber pain was very common.

On the whole majority of them i.e. 99.16 percent had lumber pain. About 85.0 percent from smaller women farmers had lumber pain whereas

100.00 percent women farmers from large size of land holding had lumber pain Slight variation was found in semi-medium and medium women farmers.

Calf muscle

Calf muscle pain was common among women farmers due to adoption of various body postures like bending, squatting, standing-cum-bending etc.(91.66 percent) It was observed that among small women farmers 85.0 percent had calf muscle pain. Among the large women farmers 83.33 percent had calf muscle pain whereas slight difference was found in semi-medium and medium group of women farmers.

Chest Pain

It was noted that on the whole 46.6 percent women farmers had chest pain. Among the small women farmers 30.0 percent women had chest pain whereas 55.5 percent women farmers from large size of land holding group had chest pain. It was observed that slight variation was found in semi-medium and medium group.

Extent of Body Discomfort

Based on subjective responses of the respondent, the intensity of pain experienced by respondents was noted and were ascribed with the scores of 3, 2, 1. The overall scores was obtained by adding responses on each body part (i.e. head, neck etc.) Table 4.5reports data on Intensity of Body Discomfort.

From Table 4.5 it was found that less than half i.e. 43.33 percent of women farmers had severe body discomfort and 9.16 percent of them had mild body discomfort. Remaining 47.5 percent had moderate body discomfort. From small category of women farmer, only 10.0 percent had mild discomfort and 5.55 percent from large land size holding women farmer had mild discomfort. About 30.0 percent from small size land holding and 61.11 percent form large size land holding had severe body discomfort.

Table: 4.5 Extent of Body Discomfort

Sr. No.	Category & Score Range	Size of Land Holding				
		Small (n=20)	**Semi-medium (n= 48)**	**Medium (n=34)**	**Large (n=18)**	**Total (N=120)**
1.	Mild Discomfort (12 – 20)	2 (10.0)	5 (10.41)	3 (8.82)	1 (5.55)	11 (9.16)
2.	Moderate Discomfort (21 – 28)	12 (60.0)	25 (52.08)	14 (41.17)	6 (33.3)	57 (47.5)
3.	Severe Discomfort (29 – 36)	6 (30.0)	18 (37.50)	17 (50.0)	11 (61.11)	52 (43.33)

Figures in parentheses indicated percentage.

4.5 Type of Technologies Used by Women Farmers:

Women in rural hilly areas have been shaping the country's economy through their active participation in agriculture. Women in agriculture are performing all the activities except ploughing but very little attention has been focused on women and technology. Tools and equipment used by women farmers were not according to their body dimensions, experiences, skills and stamina as a result fo which they faced drudgery and several health hazards while performing various agricultural activities. Therefore, there is an urgent need to study the technologies used by women farmers in various organic farming activities, so that further improvement in technologies can be made and women friendly technologies can be designed. Type of technologies used by women farmers among various agricultural activities are presented in table 4.6.

Digging of Land

On the whole about 85.0 percent women farmers used kudal for digging of land and 15.0 percent used small handle hoe. Among small women farmers all women farmers i.e. 100.0 percent used kudal for digging of land; none of them used any type of hoe.

Table: 4.6 Type of Technologies/Implements Used by Women Farmers While Performing Activities.

Sr. No.	Type of Technologies/Implement	Small (n=20)	Semi-Medium (n=48)	Medium (n=34)	Large (n=18)	Total (N=120)
1.	**Digging of Land**					
(a)	Kudal	20 (100.0)	38 (79.16)	30 (88.23)	14 (77.77)	102 (85.0)
(b)	Kassi	-	-	-	-	-
(c)	Hoe (small handle)	-	10 (20.83)	4 (11.76)	4 (22.22)	18 (15.0)
2.	**Levelling of Land**					
(a)	Kassi	-	16 (33.33)	10 (29.41)	6 (33.33)	32 (25.66)
(b)	Manually	20 (100.0)	32 (66.66)	24 (70.58)	12 (66.66)	88 (73.33)
3.	**Application of Manure**					
(a)	By hand	20 (100.0)	48 (100.0)	34 (100.0)	- 18 (100.0)	120 (100.0)
(b)	By Basket	-	-	-		-
4.	**Sowing/Transplanting**					
(a)	With hand	20 (100.0)	30 (62.5	27 (79.41)	13 (72.22)	90 (75.0)
(b)	Seeder Driller	-	-	-	-	-
(c)	Behind the plough	-	18 (37.5)	7 (20.58)	5 (27.77)	30 (25.0)
5.	**Interculture**					
(a)	Kudal	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
(b)	Small handle hoe	-	-	-	-	-
(c)	Long handle hoe	-	-	-	-	-
(d)	Khurpi	-	-	-	-	-
6.	**Hoeing**					
(a)	Kudal	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
(b)	Small handle hoe	-	-	-	-	-
(c)	Long handle hoe	-	-	-	-	-
(d)	Kurpi	-	-	-	-	-
7.	**Weeding**					
(a)	Kudal	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
(b)	Small handle hoe	-	-	-	-	-
(c)	Long handle hoe	-	-	-	-	-
(d)	Khurpi	-	-	-	-	-

Table 4.6 Cont...

Table 4.6 Cont...

8. (a)	**Harvesting** With Sickle	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
9. (a) (b)	**Threshing** Thresher Manually or by hand	- 20 (100.0)	- 48 (100.0)	- 34 (100.0)	- 18 (100.0)	- 120 (100.0)
10. (a)	**Winnowing** By hand	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)

Figures in parentheses indicated percentage.

Among large land holding group 77.77 percent used kudal and rest of them i.e. 22.22 used small handle hoe. Among semi-medium and medium women farmers most of them used kudal for digging of land.

Levelling of Land

It was observed that while levelling of land was done 73.33 percent women did manually and rest of them i.e. 26.66 percent used kassi. Among small land holding farmers majority of them i.e. 100.0 percent levelling of land manually or by hand. None of them used kassi for levelling of land. From large size land-holding women farmers i.e. 66.66 percent did levelling of land manually. Rest of them used kassi for levelling of land. Levelling of land was done manually among medium and semi-medium women farmers.

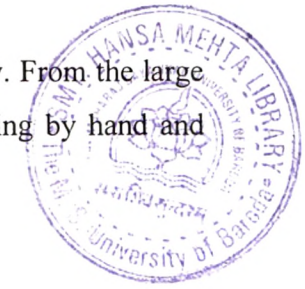
Application of Manure

It was recorded that for applying manure in the field all the women farmers used hand. None of them used basket. No variation was observed on the basis of size of land holding.

Sowing

It was observed that while sowing of seeds was done 75.0 percent women used hand and 25.00 percent of women sowed seeds behind the plough. None of them used seeds driller or seeder for sowing of seeds.

Among small women farmers all of them did sowing manually. From the large size land holding women farmers i.e. 72.22 percent did sowing by hand and rest of them i.e. 27.77 percent sowed seeds behind the plough.



Interculture

It was recorded that for interculture in the field all the women farmers used kudal. No variation was found on the basis of size of land holding. None of them used small handle or long handle hoe and khurpi for interculture.

Hoeing

It was noted that for hoeing, kudal was used as a traditional technology. They did not use any other type of technology. No variation was observed on the basis size of land holding. Small handle or large handle hoe and khurpi were not used by any of the women farmers.

Weeding

It was found that only kudal was used for weeding. Hundred percent women farmers were doing weeding with the help of kudal. No variation was found on the basis of size of land holding. Other tools such as long & short handle hoe or khurpi were not used.

Harvesting

It was observed that for harvesting all the women farmers used traditional sickle. None of them used other technology. No difference was observed on the basis of size land holding.

Threshing

It was noted that threshing was done manually by hand. None of them used thresher. It was found that no difference was seen on the basis of size of land holding.

Winnowing

When winnowing was doneby hand by100.00 percent women farmers used hand. None of them used any other type of technology

4.5 Posture Adopted by Women Farmers for Performing the Various Types of Activities

Women farmers have to spend considerable amount of time in carrying out various activities of agriculture during lean and peak season. During digging of land, levelling of land, sowing, weeding, hoeing, harvesting women farmers adopted various type of body posture. Postures adopted by women farmers in various agricultural activities are described in table 4.9.

Digging of Land

It was noted that while digging of land by women farmers, on the whole about 68.33 percent adopted bending body posture and remaining adopted squatting body posture. (i.e. 31.66 percent). Among the small women farmers 65.0 percent adopted bending posture where as 88.88 percent from the category of large women farmers also adopted similar posture. Slight variation was found in semi-medium and medium women farmers group.

Levelling of Land

During this activity 75.00 percent women farmers adopted squatting posture. Out of the total sample and 25.00 percent women farmers adopted bending posture. Among small women farmers 55.00 percent adopted squatting and 11.11 percent of large size women farmers adopted squatting posture. Slight variation was found in posture adopted by semi-medium and medium women farmers while levelling of land.

Table No. 4.7 Posture Adopted by Women Farmers for Performing the Various Types of Activities

Sr. No.	Activities	Small (n=20)	Semi-Medium (n = 48)	Medium (n = 34)	Large (n=18)	Total (N=120)
1.	**Digging of Land**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-	-	-	-	-	-
(c)	bending	13	28	25	16	82
	Bending	(65.0)	(75.0)	(73.52)	(88.88)	(68.33)
(d)		9	14	11	4	38
	Squatting	(45.0)	(29.16)	(32.35)	(22.22)	(31.66)
2.	**Levelling Land**					
(a)	Stanching	-	-	-	-	-
(b)	Standing-cum-	-	-	-	-	-
(c)	bending	9	12	7	2.	30
	Bending	(45.0)	(25.0)	(20.58)	(11.11)	(25.00)
(d)		11	36	27	16	90
	Squatting	(55.00)	(78.0)	(79.41)	(88.8)	(75.00)
3.	**Application of Manure**					
(a)	Standing	16	38.	29	16	99
		(80.0)	(79.16)	(85.29)	(88.88)	(82.5)
(b)	Standing-cum-	4	10	5	2	21
	bending	(20.0)	(28.83)	(14.70)	(11.11)	(17.50)
(c)		-	-	-	-	-
(d)	Bending	-	-	-	-	-
	Squatting					
4.	**Sowing**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-	-	-	-	-	-
(c)	bending	20	48	34	13	120
	Bending	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
(d)		-	-	-	-	-
	Squatting					
5.	**Interculture**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-	-	-	-	-	-
(c)	bending	9	17	8	3	37
	Bending	(45.0)	(35.41)	(23.52)	(16.66)	(30.83)
(d)		11	31	26	15	83
	Squatting	(55.0)	(64.58)	(76.43)	(83.33)	(69.16)

Table 4.7 Cont...

Table 4.7 Cont...

6.	**Hoeing**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-bending	-	-	-	-	-
(c)	Bending	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
(d)	Squatting	-	-	-	-	-
7.	**Weeding**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-bending	-	-	-	-	-
(c)	Bending	11 (55.0)	20 (41.66)	10 (29.41)	4 (22.22)	45 (37.5)
(d)	Squatting	9 (45.0)	28.0 (58.33)	24 (70.58)	14 (77.77)	75 (62.50)
8.	**Harvesting**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-bending	-	-	-	-	-
(c)	Bending	-	-	-	-	-
(d)	Squatting	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
9.	**Threshing**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-bending	-	-	-	-	-
(c)	Bending	-	-	-	-	-
(d)	Squatting	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)
10.	**Winnowing**					
(a)	Standing	-	-	-	-	-
(b)	Standing-cum-bending	-	-	-	-	-
(c)	Bending	-	-	-	-	-
(d)	Squatting	20 (100.0)	48 (100.0)	34 (100.0)	18 (100.0)	120 (100.0)

Figures in parentheses indicated percentage.

Application of Manure

Majority of women farmers i.e. 82.5 percent adopted standing posture while application of manure and rest of them i.e. 17.50 adopted squatting posture. Among the small women farmers 80.0 percent adopted standing posture for application of manure. About 88.88 percent women farmers from the large size land holding adopted standing posture while application of

manure in the field. Similarly the other two groups of farmers adopted standing posture rather than squatting posture.

Sowing

During Sowing/transplanting of seeds 100.00 percent women farmers used bending posture.

Interculture

On the whole majority of women farmers i.e. 69.16 percent of women farmer adopted squatting posture during interculture activity and rest of them i.e. 30.83 percent adopted bending posture while performing activity of interculture. More than half i.e. 55.0 percent of women farmers from small size land holding adopted squatting posture during interculture and 83.33 percent from large size land holding women farmer adopted squatting posture while interculture. There were slight variation found in semi-medium or medium group.

Hoeing

Hundred percent women farmers adopted bending posture during activity of hoeing. No variation was found on the basis of size of land holding.

Weeding

Approximately 62.50 percent of women farmers from the total sample adopted squatting posture during activity of weeding. About more than half i.e. 55.0 percent of women farmers from small size land holding adopted bending posture during weeding. Majority of large size land holding farmers i.e. 77.77 percent adopted squatting posture during weeding. Slight variation was found in adoption of squatting posture in semi-medium and medium women farmers during activity of weeding.

Harvesting

On the whole all women farmer i.e. 100.0 percent adopt squatting posture during activity of harvesting

Threshing

Hundred percent women farmers adopt squatting posture while they perform the activity of threshing. No variation was found on the basis of size of land holding.

Winnowing

When winnowing was done all women farmers i.e. 100.0 percent adopted squatting posture while performing of the activity of winnowing.

4.6 Time Spent and Distance Traveled by Women Farmers for Performing Various Activities:

Women farmers have to spend considerable amount of time in carrying out various agricultural activities during lean and peak season. During hoeing, weeding, harvesting, women farmers have to spend 6 – 8 hours in a field. Chakravarti (1995) found that a female spent 15-17 hours in a day out of which 8 to 9 hours were spent on farm, 3-4 hours in care of animals and 3-4 hours in attending household chores during peak season. Average time spent, distances traveled by women farmers in various agricultural activities are described in table 4.8.

Digging of Land

When digging of land/seed bed preparation was done distance traveled by them were 42.0 meters. It was found that when digging of land/seed bed preparation was performed by the women farmers' average time spent by them was 198.0 minutes/day.

Levelling of Land

While levelling of land was done distance traveled by them were 47.5 meters. Average time spent during the activity was 203 0 minutes/day.

Table No. 4.8 Time Spent and Distance Traveled by Women Farmers for Performing Various Activity.

Sr. No.	Activities	Time Spent (min)/day	Distance Traveled (m)/day
1.	Digging of Land	198.0	42.0
2.	Levelling of Land	203.0	47.5
3.	Application of manuring	205.0	44.0
4.	Sowing	242.0	43.75
5.	Interculture	377.0	48.5
6.	Hoeing	390.0	48.25
7.	Weeding	475.0	49.5
8.	Harvesting	449.0	49.0
9.	Threshing	462.0	15.25
10.	Winnowing	446.0	3.575

Application of Manure

It was found that when application of manure in the field was carried out distance traveled by women farmers was 44.0 meters. Average time spent during application of organic manure in the field was 205.0 minutes/day.

Sowing

It was found that when sowing of seeds was done by women farmers distance traveled by them was 43.75 meter. It was found that when sowing of seeds was done by the women farmers average time spent by them was 242.0 minutes/day.

Interculture

Data revealed that when activity of interculture was performed by women farmers distance traveled by them was 48.5 meters. It was reported that during activity of interculture average time spent by women farmers was 377.0 minutes/day.

Hoeing

When hoeing was done distance traveled by women farmer was 48.25 meters. Average time spent by women farmers during hoeing was 390.0 minutes/day.

Weeding

Data revealed that when weeding was done distance traveled by women farmers was 44.5 meters. Weeding is a very time consuming activity because if proper care is not taken during weeding then productivity of crop is reduced. It was found that weeding average time spent by women farmer was 475.0 minutes/day.

Harvesting

When harvesting was done distance traveled by women farmer was 49.0 meters. Harvesting is also very time consuming activity. Average time spent by women farmers during harvesting was 449.0 minutes/day.

Threshing

Threshing is also a time consuming activity. When threshing was done distance traveled by women farmers was 15.25 meters. It was observed that during threshing average time spent by women farmers was 462.0 minutes/day.

Winnowing

When winnowing was done distance traveled by women farmers was 3.57 meters. After harvesting and threshing of crops, winnowing was done. It was repoted that during winnowing average time spent by women farmers was 446.0 minutes/day.

Experimental Data

4.7 Ergonomics Assessment of Various Agricultural Activities

Erognomics (Human Engineering) is the scientific study of relationship between man / women and his / her working environment. The term environment includes tools and materials, method of work, ambient conditions, physical environment and organization of work. The women farmers involved in organic farming perform several activities like digging of land, levelling of land, application of manure, sowing, interculture, hoeing weeding, harvesting, threshing and winnowing. Greater section of the population working on Indian farm use traditional work method /tools for performing farming activities. These methods of equipments cause fatigue and different types of work related illness. These problems in turn, reduce the productive capacity of the human workers. Ergonomics and its applications attempt to harmonize work and the working environment to raise the productivity and work efficiency through the optimal use of the human worker without jeopardizing his health and safety (Gite et al 2001). Now a days it is being realized that ergonomics is equally important and relevant in agricultural activities as most of the rural women are exclusively involved in agriculture. Therefore, this section deals with physical fitness of women farmers involved in organic farming. Besides, this physiological cost work in terms of heart rate, energy expenditure, T.C.C.W, muscular stress and postural stress were also examined in various agricultural activities performed by women farmers involved in organic farming.

Physical Fitness Test of Selected Women farmers

Physical fitness index (PFI) is important parameters. It is necessary because with the help of physical fitness test we can select fit subjects for experimental work and reduce the bias in data based on physical fitness.

Physical fitness index (PFI) and body type (Ponderal Index) of women farmers were examined and reported in table 4.9.

Physical fitness Index

Physical fitness index of women farmers were examined with the help of step – stool ergometer. First of all women farmers were given enough of rest and then her resting heart rate was measured with the help of heart rate monitor (Polar Heart Rate). After complete rest, the women was asked to do the stepping activity on the step – stool ergometer. During the stepping activity heart rate of the respondents was recorded for the entire stepping period with an interval of one minute each. After 5 minutes of stepping activity, the women was asked to sit on the resting chair and her recovery pulse rate for 5 minute at an interval of one minute each was again recorded in the same way then the physical fitness score was calculated according to prescribed formula(ACRIP,2001)

From table 4.9 it was evident that out of six women farmers three of them were having good (116 – 135) PFI and only one of them were having very good physical fitness index (136 – 150). None of them were having excellent (beyond 150), poor (upto 80) and low average (81 – 100) PFI. Physical fitness index of women farmers ranged 106.37 – 139.0. This finding was similar to the one reported in AICRP report (2001).

Body Type (Ponderal Index)

The numerical value of weight – height relationship i.e. Ponderal index was useful for the purpose of crude nutritional assessment. Ponderal index was divided into three categories, ectomarp (Slender, very thin body with prominence of skin surface area), Mesomaprh (Athletic type body with well developed musculo skeletal system) and Engomorph (Abdominal physical type) i.e. protrusion of the abdomen and has large digestive organs. It was necessary to select physically fit subjects for experimental workas it and reduces the bias in data. It is calculated with the help of formula of Basu, et.al. (1994).

Ponderal index of women farmers ranged from 22.49 to 24.99. Majority of women farmers i.e. 100.0 percent fell under the category of mesomorphic i.e. athletic type body with well developed musculoskeletal system. (table 4.9)

Table 4.9 Physical Fitness test and Ponderal Index(PI) of Selected Women Farmers

S.No.	Physical fitness Index (PFI)	Women farmers	Body Type (PI)	Women farmers (n=6)
1	Poor (Upto 80)	-	-	-
2	Low Average (81 – 100)	-	-	-
3	High Average (101 – 115)	2 (33.33)	Ectomorphic (< 21.5)	
4	Good (116 – 135)	3 (50.00)	Mesomorphic (21.5 – 25)	6 (100.00)
5	Very Good (136 – 150)	1 (16.66)	Endomorphic (>25)	-
6	Excellent (byond 150)	-	-	-
	Mean ± S.D.	117.53 ± 6.73	-	-

n = sample size

$$PFI = \frac{Duration\ of\ stepping}{Sum\ of\ 1st, 2nd\ and\ 3rd\ \min\ recovery\ H.R.} \times 100$$

$$PI = \frac{1000 \times \sqrt[3]{weight(kg)}}{stature(cm)}$$

Anthropometrics Measurements of Selected Women Farmers

The anthropometrics characteristics of any population are dependent upon the large number of biological, social and demographic variables (Pheasant 1986). Knowledge of anthropometrics dimensions is an important requisite for the designing of workspace, workplace and equipment. Population of different places, region varies in their anthropometrics characteristics. This could be due to ethnic and biological characteristics and food habits. Important body measurements for reaches were investigated. The detailed analysis of anthropometrics measurements is presented in this section.

Stature

Analysis of the table 4.10 shows that mean normal standing height of the respondents was 154.2 ± 4.97 cm. Normal standing height of the respondents varied from 142.50 to 161.1 cm. with 5th and 95th percentiles to be 147.9 and 162.1 cm, respectively.

Elbow height

The mean elbow height of the women farmers was measured as 99.50 ± 3.567. The elbow height of the women farmers varied from 87.9 to 110.5 cm. with 5th and 95th percentiles were found to be 95.6 and 104.5 cm respectively.

Table – 4.10 Anthropometrics Dimensions of the Selected women farmers

Sr. No.	Dimension (cm)	Mean	SD	5th Percentile	95th Percentile	Min.	Max.
1	Weight (Kg.)	48.9	5.951	39.9	55.7	36.0	58.0
2	Stature	154.2	4.970	142.3	161.0	140.0	162.0
3	Elbow height	99.50	3.567	95.6	104.5	87.9	110.5
4	Knee height	48.70	2.39	35.1	47.4	40.0	45.6
5	Sitting height	91.50	3.97	82.5	102.5	88.5	95.7
6	Knee height (sitting)	45.3	3.12	37.2	50.1	41.0	46.0
7	Thumb tips reach	73.9	3.17	66.7	80.9	72.4	75.3
8	Forearm hand length	42.3	3.15	34.2	51.8	40.0	45.3
9	Elbow grip length	32.7	2.91	25.2	40.1	30.3	35.5
10	Foot length	22.2	1.19	20.7	25.7	20.7	24.8
11	Shoulder grip length	69.2	3.21	68.2	7.7	67.2	71.3
12	Hand length	17.3	0.89	16.3	18.6	18.3	18.1
13	Hand circumference	19.2	0.97	17.2	20.1	18.1	22.1
14	Fist length	10.0	0.31	8.88	12.50	8.57	12.56
15	Mean hand grip length	7.5	0.12	6.0	8.9	6.2	9.0
16	Grip inside diameter	3.5	0.07	3.0	4.0	3.1	4.2
17	Wrist center of grip	8.32	0.41	7.12	9.31	7.01	9.35

Knee Height

The mean knee height of the women farmers was found to be 43.70 ± 2.39 cm. The knee height of women farmers varied from 57.2 to 50.1 cm with 5^{th} and 95^{th} percentile was found to be 35.1 and 47.4 cm, respectively.

Sitting height

It was observed that the mean sitting height of the women farmers was 72.30 ± 3.10 cm. It varied from 68.7 to 75.0 cm. with 5^{th} and 95^{th} percentile respectively.

Thumb tips reach

The mean thumb tip reach of the women farmers was 73.9 ± 2.14 cm. The thumb tip reach of the women farmers was varied from 72.4 to 75.3 cm with 5^{th} and 95^{th} percentile, 66.7 and 80.9 cm. respectively.

Elbow grip length

The mean elbow length of the women farmers was 32.7 ± 2.91 cm (5^{th} and 95^{th} percentiles were found to be 25.2 and 40.1 cm. respectively). It varied from 30.3 to 35.5.

Buttock knee length

The mean buttock knee length of the women farmers was 50.1 ± 2.21 cm. (5^{th} and 95^{th} percentiles were found to be 45.3 and 55.9 cm, respectively). It varied from 49.1 to 53.0 cm.

Shoulder grip length

It was found that the shoulder grip length of the women farmers was 50.7 ± 2.21 cm (5^{th} and 95^{th} percentile were found to be 65.2 to 73.7 cm, respectively). It varied from 67.2 to 71.3 cm.

Hand length

The mean hand length of the women farmers was 17.3 ± 0.89 cm (5^{th} and 95^{th} percentile were found to be 16.3 land 18.5 cm, respectively). It varied from 15.3 to 18.1 cm.

Hand circumferences

The mean hand circumferences of the women farmers was 19.2 ± 0.97 cm. It was observed that it varied form 18.1 to 22.1 cm with 5^{th} and 95^{th} percentile found to be 17.2 and 20.1 cm, respectively).

Fist length

Mean fist length was 10.0 ± 0.31cm.It was observed that it varied from 8.57 to 12.50 cm. with 5^{th} and 95^{th} percentile i.e. 8.88 to 12.50cm., respectively.

Grip inside diameter

It was found that mean hand grip length was 3.5 ± 0.07 cm.(5^{th} and 95^{th} percentile were noted that 3.0 cm. and 4.0cm.) it varied from 3.1cm. to 4.2 cm.

Mean hand length

Mean hand length was 7.5± 0.12 cm. with 5^{th} and 95^{th} percentile i. e. 6.0cm. and 8.9 cm., respectively.

Wrist wall length

It was noted that mean wrist wall length was 52.8 ± 3.92 (5^{th} and 95^{th} percentiles were found to be 48.2cm. and 59.2 cm, respectively). It varied from 50.4 to 54.3 cm.

Wrist center of grip

It was found that mean was 8.32 ± 0.41 cm. (5^{th} and 95^{th} percentiles were found to be 7.12 and 9.31 cm, respectively). It varied from 7.01cm to 9.38 cm.

Heart Rate (beats / min) of Women Farmer During activities with Traditional and Modified Technology

Heart rate is the number of ventricular beats per minute. It is a sensitive and fine discriminating measure for evaluating strain in muscular work. In addition to this, heart rate can be measured and analyzed easily in practice without any disturbance to the worker by using radio telemetric equipment. Therefore, heart rate has been taken as an evaluating measure for setting the rest allowance, which compensate for the fatiguing effects of physical strain.

In many types of work, the increase in heart rate is linear with the increase in physiological cost of work. It has been shown by many researchers that the rate of a person's heart beat increases significantly when the person performs a physical task, works in a hot atmosphere, or simply when the person is anxious about the outcome of a particular situation in which he / she is involved. Prolonged exercise in a hot environment causes a higher hear rate then exercise at a low room temperature. Emotional factors, nervousness and apprehension may also affect the heart rate at rest and during work of light and moderate intensity. The heart rate at a given oxygen consumption rate is higher when the work is performed with the arms than with the legs. Static (isometric) exercise also increase the heart rate above the value expected from work load. The mechanism for this difference in heart rate response to exercise is not understood. However, the elevated heart rate is usually accompanied by a decrease in stroke volume.

It is beyond doubt that farming activities demand a high degree of physiological cost in terms of heart rate. Physiological cost in terms of heart rate (beats / min) of six women farmers were recorded during different agricultural activities. Procedure for recording was based on test code provided by Central Institute of Agricultural Engineering (CIAE), Bhopal. The three trials were planned statistically using randomized plot design so as to get meaningful data. Each trail was 15 minutes work was calculated with the help of a formula (ACRIP Report 2001).

From table 4.11 it was observed that heart rate of women farmers increased while performing various agricultural activities with the help of traditional and modified technologies.

Digging of land

It was observed that when women farmers were digging the land with the help of traditional technologies mean heart rate activity was 77.66 beats / min and mean heart rate during activity was 138.66 beats / min. mean difference in heart rate was 60.00 beats / min. Table 4.11 also throws light on percentage increase in heart rate during activity. It was observed that when digging of land with the help of traditional technologies percentage increase in mean heart rate was 77.25, while digging of land with the help of modified technologies mean heart rate during the activity was 134.66 beats / min and before the activity was 78.77 beats / min.

Mean difference in heart rate during activities and before activity was 55.89 beats / min and percentage increase in heart rate during activity was 70.95 percent.

Table 4.11 Heart Rate (bests/min) of Women Farmers During Activities with Traditional and Modified Technology.

S.No.	Activities	Heart rate before activity (beats / min)	Heart rate during work (beat / min)	Δ HR (beat / min)	% increase in heart rate
1.	**Digging of land**				
(a)	Traditional	77.66	138.66	60.00	77.25
(b)	Modified	78.77	134.66	55.89	70.95
	Difference	±1.11	±4.00	±4.11	±6.3
2.	**Levelling of land**				
(a)	Traditional	78.94	127.62	48.68	61.66
(b)	Modified	80.38	125.46	45.08	56.08
	Difference	±1.44	±2.16	±3.60	±5.58
3.	**Application of manure**				
(a)	Traditional	80.05	122.49	42.44	53.01
(b)	Modified	79.05	118.16	39.11	49.47
	Difference	±1.00	±4.33	±3.33	±3.54
4.	**Sowing**				
(a)	Traditional	81.33	117.83	36.50	44.87
(b)	Modified	79.16	125.05	45.89	57.97
	Difference	±2.17	±7.22	±9.39	±13.10
5.	**Interculture**				
(a)	Traditional	80.88	130.88	50.00	61.81
(b)	Modified	79.16	125.05	45.89	57.97
	Difference	±2.17	±7.22	±9.39	±13.10
6.	**Hoeing**				
(a)	Traditional	80.66	133.26	52.60	65.21
(b)	Modified	79.16	127.83	48.67	61.48
	Difference	±1.50	±5.43	±3.93	±3.73
7.	**Weeding**				
(a)	Traditional	78.94	122.33	43.39	54.94
(b)	Modified	80.83	12.90	40.07	49.57
	Difference	±1.89	±1.43	±3.32	±5.39

Table 4.11 Cont...

Table 4.11 Cont...

8.	**Harvesting**				
(a)	Traditional	78.66	118.99	40.33	51.27
(b)	Modified	87.38	116.88	29.5	33.76
	Difference	±8.72	±2.11	±10.83	±17.51
9.	**Threshing**				
(a)	Traditional	79.49	115.66	36.17	45.50
(b)	Modified	78.44	110.17	31.73	40.45
	Difference	±1.05	±5.49	±4.44	±5.05
10.	**Winnowing**				
(a)	Traditional	78.83	113.38	34.89	44.25
(b)	Modified	78.84	110.66	31.82	40.36
	Difference	±0.01	±2.71	±3.07	±3.89

HR (Difference in Heart Rate) = Heart during work – HR before work

$$\% \text{ increase in heart rate} = \frac{\text{HR during work - HR before work}}{\text{HR before work}} \times 100$$

Levelling of land

While levelling of land with the help of traditional technology, mean heart rate before activity was 78.94 beat / min and mean heart rate during activity was 127.62 beats / min. mean heart rate before activity was lower then mean heart rate during activity. Mean difference in heart rate was 48.68 (beats / min). It was found that while levelling of land with the help of traditional technologies percentage increase in mean heart rate was 61.66 percent.

It was noted that while levelling of land with the help of modified technologies mean heart rate before activity was 80.38 beats / min and during activity was 125.46 beats / min. Mean difference in heart rate was 45.08 beats / min and percentage increase in mean heart rate was 56.08. percent. Working heart rate was moving in traditional as modified.

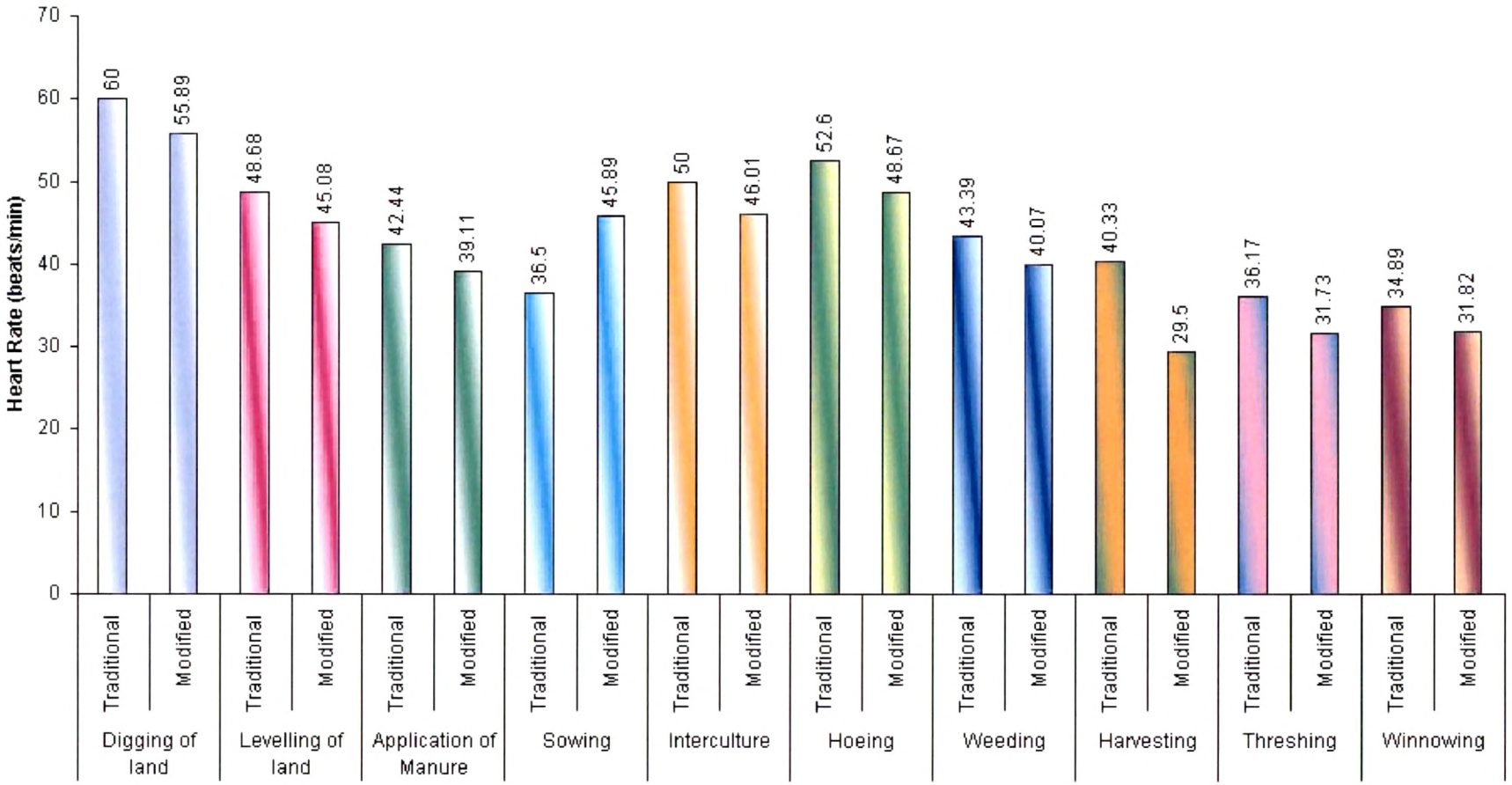


Fig 4.10 Mean Difference in Heart Rate (beats/min) of Women Farmers During Activities with Traditional and Modified Technologies

Application of manure

It was observed that while application of manure in the field with the help of traditional method, mean heart rate before activity was 80.05 beats / min and during activity mean heart rate was122.49 beats / min. Mean heart rate during activity was greater than mean heart rate before activity. Mean difference in between before activity and during activity was 42.44 beats / min. About 53.01 percent increase in heart rate during work.

When manure was applied in field by women farmers with the help of modified technologies mean heart rate before activity was 80.05 beats / min and during activity mean heart rate was 122.49 beats / min. Mean difference between before activity and during activity was 39.11 beats / min. Percentage increase in mean heart rate was 49.47 percent (Table 4.11). It was found that percentage increase in heart rate and working heart were less in modified technology.

Sowing

When sowing was done in field by women farmers with the help of traditional method, mean heart rate before activity was 81.33 beats / min and during activity were 117.83 beats / min. It was observed that mean difference in mean heart rate during activity and mean heart rate before activity was 36.50 (beats / min). Percentage increase in mean heart rate was 44.87.

It was noted that while sowing of seed was done in the field by women farmers with the help of modified technology, mean heart rate before activity was 79.16 beats / min and mean heart rate during activity was 125.05 beats / min. Mean difference and percentage increase in heart rate during work were 45.89 beats / min and 57.97 percent respectively. It was observed that when sowing of seed in the field by of traditional method working heart rate and percentage increase in heart rate were less as compared to modified technology.

Interculture

It was found that the activity of interculture was done with the help of traditional technology mean heart rate before activity was 80.88 beats / min and during activity was 130.88 beats / min. It was observed that mean difference in mean heart rate during activity and mean heart rate before activity was 50.00 (beats / min). Percentage increase in mean heart rate was 61.81 percent.

It was observed that when activity of inter culture was done with the help of modified technology, mean heart rate before activity and during activity were 46.01 (beats / min) and 58.45 beats / min respectively. It was noted that activity was interculture was done with the help of modified technology mean difference before activity and during activity was 46.01 beats / min. Percentage increase in heart rate during activity of inter culture with the help of modified technologies 58.45 percent (Table 4.11).

It was noted that during the activity of interculture with modified technology, mean working heart rate and percentage increase in heart rate were less to traditional technology.

Hoeing

Mean heart rate before the activity of hoeing with the help of traditional technology was 80.66 beats / min and during performing the activity of hoeing 133.26 beats / min. Mean difference in mean heart rate during activity and mean heart rate before activity was 52.60 beats / min. Percentage increase in heart rate during activity was 65.21 percent. During the activity of hoeing wit the help of modified technology mean heart rate before activity and during activity were 79.16 beats / min and 127.83 beats / min, respectively. Mean difference in heart rate during activity and before activity was 48.67 beats / min. About 61.48 percent increase in heart rate during work. While hoeing was done with traditional technology working heart rate and percentage increase in heart rate were more as compared modified technology.

Weeding

It was examined that when activity of weeding was done with the help of traditional technology, mean heart rate before activity and during activity as 78.94 beats / min and 122.33 beats / min respectively. Mean difference in heart rate during activity and before activity was 43.39 beats / min. Percentage increase in heart rate during work was 54.96 percent.

It was observed that while weeding was done with the help of modified technology, mean heart rate before activity and during activity were 80.83 beats / min and 120.90 beats / min respectively. Mean difference in heart rate during activity and percentage increase in heart rate during activity were 40.07 beats / min and 49.57 percent. Working heart rate and percentage increase in heart rate were less in modified technology.

Harvesting

During the activity of harvesting by women farmers with the help of traditional technologies, mean heart rate before and during activity were 78.66 beats / min and 118.99 beats / min respectively. Mean difference in heart rate during activity and before activity with the help of traditional technology was 40.33 beats / min. About 51.27 percent increase in heart rate was recorded during work.

While activity of harvesting was done with the help of modified technology, mean heart rate before activity was 37.38 beats / min and mean heart rate during activity was 116.88 beats / min. Mean difference in heart rate during activity and percentage increase in heart rate during activity were 29.5 beats / min and 33.76 percent respectively. (Table 4.11).

Working heart rate and percentage in heart rate were more in traditional technology as comparison to modified technology.

Threshing

It was found that when activity of threshing was done with the help of traditional method, mean heart rate before activity and during activity were 79.49 beats / min and 115.66 beats / min respectively. Mean difference in heart rate during activity and before activity with the help of traditional technology was 36.17 beat / min. Percentage increase in heart rate during work was 45.50 percent.

It was observed that while threshing was done with the help of modified technology, mean heart rate before activity and during activity were 78.44 beats / min and 110.17 beats / min respectively. Mean difference in heart rate during activity and percentage increase in heart rate during activity were 31.73 beats / min and 40.45 percent. It was examined that working heart rate and percentage increase in heart rate was less in modified technology as compared to traditional method.

Winnowing

During the activity of winnowing by women farmers with the help of traditional method, mean heart rate before activity and during activity were 78.83 beats / min and 113.37 beats / min, respectively. Mean difference in heart rate during activity with the help of traditional technology was 34.89 beats / min. About 44.25 percent increase in heart rate during activity.

While activity of winnowing was done with the help of modified technology, mean heart rate before activity was 78.84 beats / min and mean heart rate during activity was 110.66 beats / min. Mean difference in heart rate during activity and percentage increase in heart rate 31.82 beats / min and 40.36 percent respectively. (Table 4.11). Percentage increase and working heart rate were more in traditional method as compare to modified technology.

For the present study heart rate of women farmers were recorded before and during work in various agricultural activities. It was observed that heart

rate increased during the activity. It was also found that heart rate was greater when various activities were performed with the help of traditional technologies as compared to modified technology. Heart rate was highest during digging of land 138.66 beats / min, hoeing 133.26 beats / min, interculture 130.88 beats / min, levelling of land 127.62 beats / min, weeding 122.37 beats / min with the help of traditional technology.

It was lowest in application of manure 122.49 beats/min, sowing 117.83 beats/min, harvesting 118.99 beats / min, Threshing 115.66 beats / min and winnowing 113.3 % beats / min with the help of traditional technology.

Heart rate in various agricultural activity while performing these activity with the help of modified technology. Heart rate was highest during digging of land 134.66 beats / min, hoeing 127.83 beats / min, sowing 125.05 beats / min, interculture 124.72 beats / min, levelling of land 125.46 beats / min with the help of traditional and modified technology. It was lowest during application of manure 118.16, harvesting 116.88 beats / min, threshing 110.17 beats / min and winnowing 110.66 beats / min with the help of traditional and modified technology.

Thus, from the overall analysis and the experiments that were carried out concluded that modified technologies were better as compared to traditional technologies because while women farmers performing various types of activities, they adopted bad work posture due to improper designing of technologies and hence heart rate was more in traditional technologies.

Working Heart Rate (beats/min/m^2) of Women Farmer During Activities with Traditional and Modified Technology in Relation to Output of Work

When women farmers were doing various activities with the help of modified technologies, their were heart rate was less and output was more as compared to traditional technologies. But some activities like sowing; heart rate was more wit modified technologies but out put was also more. Therefore

investigator was interested to calculating working heart rate of various agricultural activities with traditional and modified technologies. Working heart rate in relation to output was calculated with the help of following formula given by Gite (2002).

$$WHR = \frac{\Delta HR \times Duration}{area}$$

From table 4.12 reports the comparison of the heart rate response and output of women farmers with traditional and modified technologies.

Digging of land

The mean value of heart rate was 77.66 beats / min / m^2 while activity was done with the traditional technology. The mean working heart rate, mean difference in heart rate, percentage increase in heart rate and output where 139.85 beats / min / m^2, 62.19 beats / min / m^2, 80.01 percent and 4.21 m^2 respectively.

While activity digging of land was done with the help of modified technology, mean value of heart rate before and during work were 78.77 beats / min and 125.22 beats / min / m2. Mean difference in heart rate, percentage increase in heart rate and out put (area covered by women farmers) were 46.75 beats / min / m^2, 59.35 percent and 5.95 m^2 respectively.

It was found that when activity digging of land was done with the help of traditional technology mean value of working heart rate was more and out put was less.

Table:4.12 Heart Rate (bests/min/m^2) of Women Farmers During Activities with Traditional and Modified Technology in relation to Output of Work.

S.No.	Activities	Heart rate before activity (beats / min)	Heart rate during work (beat / min / m^2)	Δ HR	% increase in heart rate	Output (m^2)
1.	**Digging of land**					
(a)	Traditional	77.66	138.85	62.19	80.07	4.21
(b)	Modified	78.77	125.52	46.75	59.35	5.95
	Difference	±1.11	± 14.33	±15.44	±20.72	±1.74
2.	**Levelling of land**					
(a)	Traditional	78.94	123.83	44.06	55.87	5.26
(b)	Modified	80.38	117.16	36.78	45.75	7.01
	Difference	±1.44	±6.67	±7.78	±10.12	±1.75
3.	**Application of manure**					
(a)	Traditional	80.05	128.73	48.68	60.08	4.21
(b)	Modified	79.05	119.13	40.08	50.70	6.75
	Difference	±1.00	±9.6	±8.6	±9.38	±2.54
4.	**Sowing**					
(a)	Traditional	81.33	130.02	48.69	59.86	4.19
(b)	Modified	79.16	118.74	39.58	50.00	6.84
	Difference	±2.17	±11.46	±9.11	±9.86	±2.68
5.	**Interculture**					
(a)	Traditional	80.88	129.43	48.55	60.02	3.65
(b)	Modified	78.71	124.16	45.25	57.77	6.27
	Difference	±2.17	±5.27	±3.1	±2.25	±2.62
6.	**Hoeing**					
(a)	Traditional	80.66	130.70	50.04	62.03	5.26
(b)	Modified	79.16	122.54	43.38	54.48	6.17
	Difference	±1.5	±8.16	±6.66	±7.55	±0.91
7.	**Weeding**					
(a)	Traditional	78.94	131.42	52.48	66.48	4.50
(b)	Modified	80.83	121.31	40.48	50.08	6.85
	Difference	±1.89	±10.11	±12.0	±16.4	±2.35

Table 4.12 Cont...

Table 4.12 Cont...

8.	**Harvesting**					
(a)	Traditional	78.66	121.69	43.03	54.70	5.27
(b)	Modified	87.38	116.56	29.18	33.39	7.95
	Difference	±8.72	±5.13	±13.85	±21.31	±2.68
9.	**Threshing**					
(a)	Traditional	79.49	111.70	32.21	40.52	3.10
(b)	Modified	78.44	105.10	26.66	33.98	5.50
	Difference	±1.05	±6.6	±5.55	±6.54	±2.40
10.	**Winnowing**					
(a)	Traditional	78.83	108.94	30.11	38.19	2.95
(b)	Modified	78.84	105.22	26.38	33.46	5.67
	Difference	±0.01	±3.72	±3.73	±4.73	±2.72

HR (Difference in Heart Rate) = Heart during work – HR before work

$$\% \text{ increase in heart rate} = \frac{\text{HR during work - HR before work}}{\text{HR before work}} \times 100$$

Levelling of land

While levelling of land with traditional technology, mean value of heart rate before and during working were 78.94 beats / min / m^2 and 123.83 beats / min / m^2 respectively. Mean difference in heart rate, percentage defference in heart rate and output were 44.06 beats / min / m^2, 55.87 percentage and 5.26 m^2 respectively.

It was observed that while levelling of land was done with the help of modified technology, mean value of heart rate before and during work were 80.38 beats / min / m^2 and 117.16 beats / min / m^2 respectively, mean difference in heart rate, percentage increase in heart rate, output were 36.78 beats / min / m^2, 45.75 percent and 7.01 m^2 respectively.

It was examined that while levelling of land was done with the help of modified technology mean value working was less and output was more.

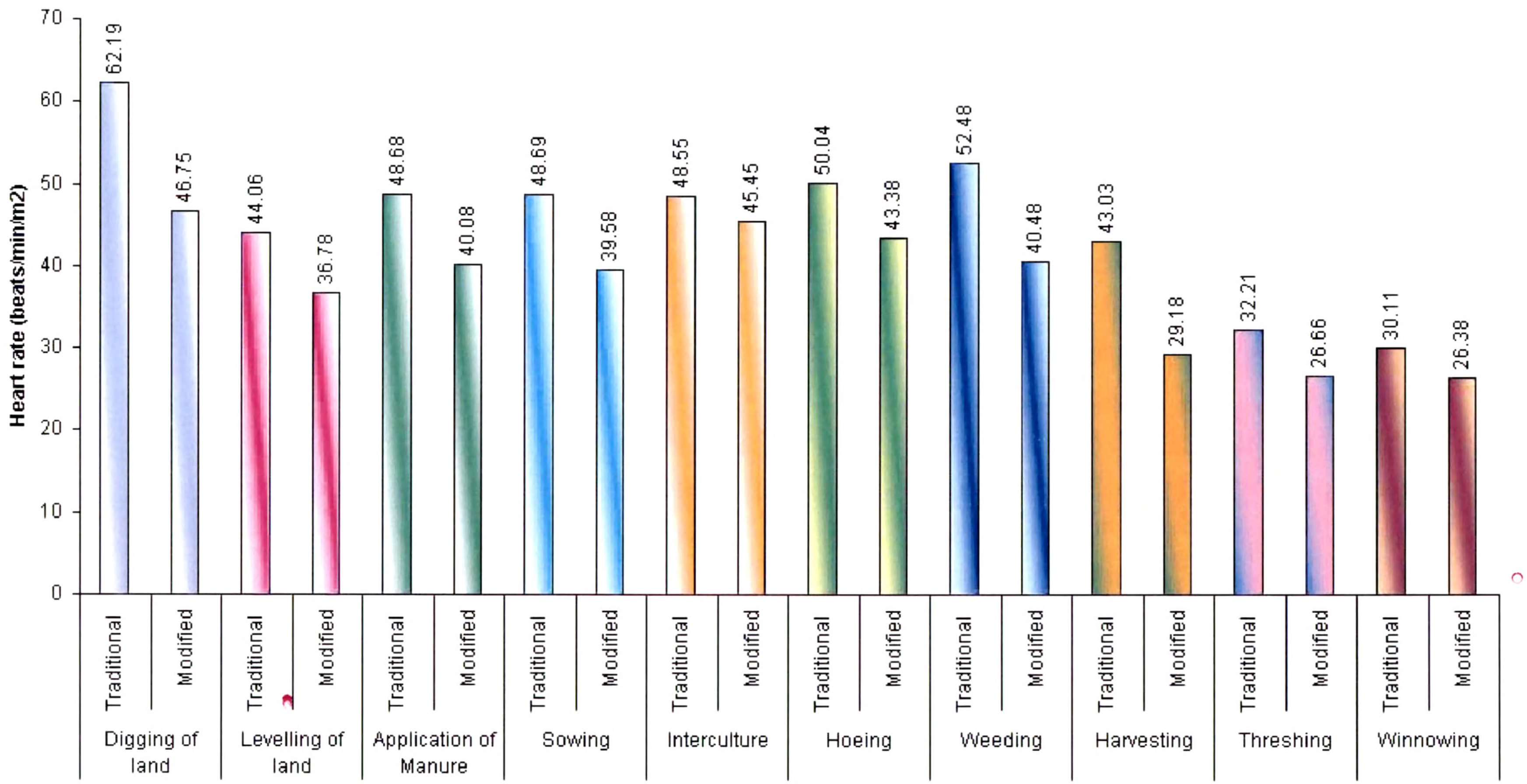


Fig 4.11 Mean Difference in Working Heart Rate (beats/min/m2) of Women Farmers During Activities with Traditional and Modified Technologies in Relation to Output of Work

Application of manure

It was found that while application of manure in the field by traditional method, mean value of the heart rate before working and during working were 80.05 beats / min / m^2 and 128.73 beats / min / m^2 with traditional technology. Mean difference in heart rate, percentage increase in heart rate and output were 48.68 beats / min / m^2 and 59.86 percent and 4.19 m^2, respectively.

When manure was applied in field by women farmers with modified technology, mean value of heart rate before working and during working were 79.05 beats / min / m^2 and 119.13 beats / min / m^2. Mean difference in heart rate percentage increase in heart rate and output were 40.08 beats / min / m^2, 50.70 percent and 6.75 m^2, respectively.

It was observed that while application of manure was done with traditional method, mean value of working heart was more and output was less.

Sowing

When sowing was done in field by women farmers with the help of traditional method, mean value of during working heart rate and before working heart rate were 130.02 beats / min / m^2 and 8133 beats / min / m^2 respectively whereas mean difference in heart rate and percentage increase in heart rate and output were 48.69 beats / min / m^2, 60.08 percent and 4.21 m^2, respectively.

During the activity of sowing of seed in the field with modified technology, mean value of working heart rate and before working were 118.74 beats / min / m^2 and 79.16 beats / min / m^2, respectively.

It was observed that when activity of sowing was done with the help of modified technology, mean value of working heart was less and output was more.

Interculture

It was found that activity of interculture was done with the help of traditional technology, mean value of heart rate before working and during was 80.88 beats / min / $m^2$and 129.43 beats / min / m^2, mean value of difference in heart rate, percentage increase in heart rate and output were 48.55 beats / min / m^2, 60.02 percent and 3.65 m^2,respectively.

During the activity of interculture was done with the modified technology, mean value of working heart rate was 124.16 beats / min / m^2. Difference in heart rate, percentage increase in heart rate and output were 45.45 beats / min / m^2, 57.77 percent and 6.27 m^2 respectively.

It was examined that when activity of interculture was done with the help of traditional technology. Mean value of working heart rate was more and output was less.

Hoeing

The mean value of heart rate before working was 80.66 beats / min / m^2 when hoeing was done with the help of traditional technology, mean value of heart rate and mean difference in heart rate were 130.70 beats / min / m^2 and 50.04 beats / min / m^2 respectively. Percentage increase in heart rate and out put were 62.03 percent and 5.26 m^2 respectively.

During the activity of hoeing with the help of modified technology, mean value of heart rate before work and during work were 79.16 beats / min / m^2 and 122.54 beats / min / m^2 respectively. Mean difference in heart rate and percentage increase in heart rate were 43.38 beats / min / m^2 and 54.48 percent respectively. Area covered by women farmers with modified technology was 6.17 m^2.

It was observed that when activity of hoeing was done with the help of modified technology, mean value of working heart rate was less and output was more.

Weeding

It was examined that when activity of weeding with the help of traditional technology, mean value of working heart rate and before working heart rate were 131.42 beats / min / m^2 and 78.94 beats / min / m^2 respectively. It was also examined that mean difference in heart rate, percentage increase in heart rate and output were 52.48 beats / min / m^2, 66.48 percent and 4.50 m^2 respectively.

It was noted that during the activity of weeding was done with the help of modified technology, mean value of working heart rate and before working heart rate were 121.31 beats / min / m^2 and 80.83 beats / min / m^2 respectively. Mean difference in heart rate, percentage increase in heart rate and output were 40.48 beats / min / m^2, 50.08 percent and 6.85 m^2, respectively.

It was observed that while activity of weeding was done with the help of traditional technology mean value of working heart rate was more and output was less.

Harvesting

During the activity of harvesting by women farmers with the help of traditional technology, mean value of heart rate before activity and during activity were 78.66 beats / min / m^2 and 121.69 beats / min / m^2, respectively. Mean difference in heart rate, percentage increase in heart rate and output were 43.03 beats / min / m^2, 54.70 percent and 5.27 m^2, respectively.

While activity of harvesting was done with the help of modified technology, mean value of heart rate before and during activity were 87.38

beats / min / m^2 and 116.56 beats / min / m^2. Mean difference in heart rate percentage increase in heart rate and output were 29.18 beats / min / m^2, 33.39 percent and 7.95 m^2 respectively.

It was observed that when activity of harvesting was done with the help of modified technology, mean value of working heart rate was less and out put was more as compared to traditional technology.

Threshing

It was found that when activity of threshing was done by traditional method, mean value of heart rate before working and during work were 78.66 beats / min / m^2 and 111.70 beats / min / m^2 respectively. Mean difference in heart rate, percentage increase in heart rate and output were 32.21 beats / min / m^2, 40.52 percent and 3.10 kg grains respectively.

During the activity of threshing was done with the help of modified technology, mean value of working heart and before working heart rate were 105.10 beats / min / m^2 and 78.44 beats / min / m^2 respectively. Mean difference in heart rate and percentage increase in heart rate and output were 29.18 beats / min / m^2, 33.39 percent and 5.50 kg grains , respectively.

It was found that when threshing was done with the help of modified technology, mean value of working heart rate was less and output was more as compared to traditional method.

Winnowing

While activity of winnowing by women farmers with the help of traditional method mean heart rate before activity and during activity were 78.83 beats / min / m^2 and 108.94 beats / min / m^2 respectively. Mean difference and percentage increase in heart rate and output were 30.11 beats / min / m^2, 38.19 percent and 2.95 kg grains respectively.

During the activity of winnowing with the help of modified technology, mean value of heart rate before and during work were 78.84 beats / min / m^2 and 105.22 beats / min / m^2 respectively. Percentage increase, mean difference in heart rate and output were 33.46 percent, 26.38 beats / min / m^2 and 5.67 kg grains, respectively.

It was examined that activity of winnowing was done with the help of traditional method, mean value of working heart rate was more and output was less.

Overall it was observed that working heart rate, mean difference in heart rate and percentage increases in heart rate was more while performing various agricultural activities with traditional technology and output was less as compared to modified technology.

Energy, Expenditure (kJ/min) of Activities with Traditional and Modified Technology

As soon as physical work is performed, energy expenditure rises sharply. The greater demand made on the muscles, the more the energy is consumed. The increased consumption of energy associated with a particular activity expressed in work calories and is obtained by measuring energy consumption while working and subtracting from this the energy consumption during rest. This energy expenditure in kJ/minutes indicate the level of bodily stress and in relation to work and can be used to asses the rest periods, different ways of arranging works and compare the efficiency of different tools. Hence, energy expenditure should be used as a measure for strenuous physical effort rather than for mental activities.

Women farmers involved in organic farming have to perform various agricultural activities. Therefore, in table 4.13, an attempt was made to calculate the energy expenditure (kJ/min) among various agricultural activities with the help of traditional and modified technologies and find out the difference in energy expenditure between traditional and modified technology. It is calculated with the help of following formula

EE = 0.159 x Average working heart rate – 8.72

It is described under following sub headings.

Digging of land

It was observed that when women farmers were digging the land with the help of traditional technology, mean energy expenditure before activity was 3.646 kJ/min and mean energy expenditure during activity was 13.248 kJ/min. Mean difference in energy expenditure during work was 9.602 kJ/min. Table 4.16 also throw light on percentage increase in energy expenditure during activity. It was observed that when digging of land with the help of traditional technologies, percentage increase in mean energy expenditure was 263.350.

While digging of land with the help of modified technologies, mean energy expenditure during the activity was 11.564 kJ/min and before the activity was 3.750 kJ/min. Mean difference in energy expenditure during activities and percentage increase in energy expenditure were 8.938 kJ/min and 238.35 percent respectively. Energy expenditure and percentage increase in energy expenditure was more in traditional technologies.

Table 4.13. Energy Expenditure (kJ/min) of Women Farmer During Activities with Traditional and Modified Technology.

S.No.	Activities	Energy Expenditure before activities (kJ/min)	Energy Expenditure before activities (kJ/min)	Δ EE	% increase in Energy Expenditure
1.	**Digging of land**				
(a)	Traditional	3.646	13.248	9.602	263.350
(b)	Modified	3.750	12.6880	8.938	238.350
	Difference	±0.104	±0.560	±0.665	±25.0
2.	**Levelling of land**				
(a)	Traditional	3.8316	11.564	7.734	201.806
(b)	Modified	4.059	11.225	7.163	176.479
	Difference	±0.227	±0 339	±0.571	±25.327
3.	**Application of manure**				
(a)	Traditional	4.028	10.757	6.729	167.043
(b)	Modified	4.016	10.068	6.218	154.36
	Difference	±0.012	±0.689	±0.511	±12.683
4.	**Sowing**				
(a)	Traditional	4.211	10.015	5.803	137.660
(b)	Modified	4.034	11.179	7.140	177.110
	Difference	±0.177	±1.164	±1.337	±39.45
5.	**Interculture**				
(a)	Traditional	4.046	12.064	8.0174	198.126
(b)	Modified	4.016	11.110	7.339	182.744
	Difference	±0.03	±0.954	±0.678	±15.382
6.	**Hoeing**				
(a)	Traditional	4.1056	12.463	8.357	203.56
(b)	Modified	3.831	11.110	7.279	190.00
	Difference	±0.2746	±1.353	±1.078	±16.56
7.	**Weeding**				
(a)	Traditional	3.184	10.728	6.878	178.686
(b)	Modified	4.059	10.492	6.433	153.909
	Difference	±0.875	±0.236	±0.445	±19.77
8.	**Harvesting**				
(a)	Traditional	3.787	10.200	6.413	169.342
(b)	Modified	3.743	9.865	6.122	163.560
	Difference	±0.044	±0.335	±0.291	±5.782

Table 4.13 Cont...

Table 4.13 Cont...

9.	**Threshing**				
(a)	Traditional	3.920	9.706	5.786	147.60
(b)	Modified	3.752	8.787	5.035	134.193
	Difference	±0.168	±0.919	±0.751	±13.397
10.	**Winnowing**				
(a)	Traditional	3.560	9.361	5.801	162.940
(b)	Modified	3.617	8.867	5.249	145.127
	Difference	±0.0573	±0.494	±0.552	±17.813

Δ EE (Difference in Energy Expenditure) = Energy expenditure during work – Energy expenditure before work.

$$\% \textit{ increase in Energy Expenditure} = \frac{\text{EE during activities x EE before activities}}{\text{EE before activities}} \times 100$$

Levelling of land

When levelling of land with the help of traditional technology, mean energy expenditure before activity was 3.8316 kJ/min. Mean difference in energy expenditure was 7.734 kJ/min. It was found that while levelling of land with the help of traditional technology, percentage increase in mean energy expenditure was 201.806 percent.

It was noted that when levelling of land by women farmers with the help of modified technologies mean energy expenditure during activity and before activity were 11.225 kJ/min and 4.059 kJ/min respectively. It was found that energy with the help of modified technology was less as compared to traditional technology.

Application of manure

It was observed that when application of manure in the field with the help of traditional method was carried out mean energy expenditure before activity was 4.028 kJ/min and during activity was 10.757 kJ/min. Mean energy expenditure during activity was greater then mean energy expenditure before activity. Mean difference in energy expenditure between before activity and during activity was 6.729 kJ/min. About 167.043 percent increase was seen in energy expenditure during work.

When application of manure was applied in field by women farmers with the help of modified technologies, mean energy expenditure before activity was 4.028 kJ/min and during activity mean energy expenditure was 10.757 kJ/min. Mean difference in energy expenditure during activity was 16.218 kJ/min. percentage increase in mean energy expenditure was 161.541 percent (Table 4.13). Energy expenditure and percentage increase in energy expenditure were less in modified technology.

Sowing

While sowing of seed in field by women farmers with the help of traditional method, mean energy expenditure before activity and during activity were 4.21 kJ/min and 10.015 kJ/min respectively. It was examined that mean difference in energy expenditure during activity and before activity was 6.729 kJ/min. About 167.043 percent energy expenditure was seen increase during activity.

It was noted that while activity of sowing of seed was done in the field by women farmers with the help of modified technology, mean energy expenditure before activity was 4.034 kJ/min and during activity was 10.068 kJ/min. Mean difference and percentage increase in heart rate during work were 7.140 kJ/min and 177.110 percent respectively. When above activity was done with the help of traditional technology energy expenditure during and before work and percentage increase in energy expenditure was less as compared to traditional technologies.

Interculture

It was found that when the activity of interculture was done with the help of traditional technology, mean expenditure before activity was 4.046 kJ/min and during activity was 12.064 kJ/min. It was observed that mean

difference in energy expenditure during activity and before activity was 8.0174 kJ/min. Percentage increase in mean energy expenditure 198.126 percent.

It was found that when activity of interculture was done with the help of modified technology, mean energy expenditure before activity and during activity were 3.770 kJ/min and 11.110 kJ/min respectively. It was noted that when activity of interculture was done with the help of modified technology, mean difference before activity and during activity was 8.0174 kJ/min. Percentage increase in energy expenditure during activity of interculture with the help of modified technologies 194.65 percent. It was examined that when activity of interculture was done with the help of modified technology mean energy expenditure during activity, difference in mean energy expenditure during activity and percentage increase in energy expenditure was less as compared to traditional technology.

Hoeing

Mean energy expenditure before the activity of hoeing with the help of traditional technology was 4.156 kJ/min and during performing of the activity of hoeing mean energy expenditure was 12.463 kJ/min. Mean difference in mean energy expenditure was 8.357 kJ/min. Percentage increase in energy expenditure during activity was 203.56 percent.

During the activity of hoeing with the help of modified technology mean energy expenditure before activity and during activity were 3.8140 kJ/min and 11.110 kJ/min respectively. Mean difference in energy expenditure during activity was 7.2916 kJ/min. About 191.129 percent increase in energy expenditure during work.

There was a difference in mean energy expenditure during work, mean difference in energy expenditure and percentage increase during activity while performing activity of hoeing was done with the help of modified and

traditional technology. All parameters sows more energy expenditure were more in traditional technology as compared modified technology.

Weeding

It was examined that when activity of weeding was done with the help of traditional technology, mean energy expenditure before activity and during activity were 3.184 kJ/min and 10.728 kJ/min respectively. Mean difference energy during activity and before activity 178.686 kJ/min. Percentage increase in energy expenditure during work was 178.686 percent.

It was noted that while weeding was done with the help of modified technology, mean energy expenditure before activity and during activity were 4.132 kJ/min and 10.492 kJ/min. Mean difference in energy expenditure during activity and before activity was 6.360 kJ/min. About 153.909 percent increase in energy expenditure during activity.

During the activity of weeding by women farmers with the help of modified technologies energy expenditure during work, mean differences in energy expenditure and percentage increase in energy expenditure were less as compared to traditional technologies.

Harvesting

While the activity of harvesting was done by women farmers with the help of traditional technologies mean energy expenditure before activity during activity were 3.787 kJ/min and 10.200 kJ/min. Percentage increase in energy expenditure during work was 169.342 percent.

It was found that when activity of harvesting was done with the help of modified technology mean energy expenditure before activity was 3.743 kJ/min and mean energy expenditure during activity was 9.865 kJ/min. Mean difference in energy expenditure during activity and percentage increase in

energy expenditure activity were 6.122 kJ/min and 163.560 percent respectively.

It was observed that harvesting was done with the help of modified technology, mean energy expenditure during activity, mean difference between during activity and before activity and percentage increase in energy expenditure were less as compared to modified technology. (Table 4.13)

Threshing

It was found that when activity of threshing was done with the help of traditional method mean energy expenditure before activity and during activity were 3.920 kJ/min and 9.706 kJ/min respectively. Mean difference in between during activity and before activity and percentage increase in energy expenditure were 5.786 kJ/min and 186.6 kJ/min respectively.

It was found that while threshing was done with the help of modified technology, mean energy expenditure during activity and mean difference in between during activity and before activity were 8.787 kJ/min and 6.122 kJ/min respectively, percentage increase in energy expenditure during work 163.560 percent.

It was examined that there was a difference in energy expenditure while threshing was done with the help of modified and traditional technology.It was found to be more in traditional technology

Winnowing

During the activity of winnowing by women farmers with the help of traditional method, mean energy expenditure before activity and during activity were 3.560 kJ/min and 9.361 kJ/min respectively. Percentage increase in energy expenditure 5.801 percent during the activity of winnowing, mean

difference in energy expenditure before activity and during activity was 5.801 kJ/min.

While the activity of winnowing was done with the help of modified technology, mean heart rate before activity was 3.6173 kJ/min and during activity was 8.867 kJ/min. Mean difference in energy expenditure during activity and before activity and percentage increase in energy expenditure during activity were 5.2497 kJ/min and 145.1275 percent respectively.

It was found that while winnowing was done with the help of modified technology energy expenditure was less as compared to traditional technology.

Heavy work in any activity leads to greater physical exertion and is characterized by a high energy consumption and severe stress on the heart and lungs. Energy consumption and cardiac capacity set limits to the performance of heavy work and these two functions are often used to assess the degree of severity of a physical work. (Grandjean, 1979). As soon as physical work is performed, energy consumption rises sharply. The greater the demands made on the muscles by one occupation the more energy consumed. The increased consumption associated with a particular activity expressed in work calories or kilo jule. These work calories indicate the level of body stress. Hence energy expenditure should be used as a measure of comparison only for strenuous physical efforts and never for studying mental activities or skilled and never studying mental activities or skilled work. Lehmann (1953) reported that on agricultural labourer's daily energy consumption was 4200 kcal/day. Many researches have shown that a healthy occupation should involve a daily energy consumption of 3000 – 3500 kcal for a man, with 2500 – 3000 kcal for women. From the findings of the present study it was observed that energy expenditure during digging of land 13.248 kJ/min, hoeing 12.463 kJ/min, interculture 12.064 kJ/min, levelling of land 11.564 kJ/min weeding 10.728 kJ/min were highest while performing these activity with the help of traditional technology.

Energy expenditure was lowest during winnowing 9.361 kJ/min and sowing 10.015 kJ/min, harvesting 10.200 kJ/min and sowing 10.015 kJ/min with the help of traditional technology.

Thus, from the entire analysis it could be concluded that when women farmers were working with modified technologies, energy expenditure was less as compared to traditional technologies.

Total Cardiac Cost of Work (beats) of Activities with Traditional and Modified Technologies

Total cardiac cost of work was calculated by using the following formula –

T.C.C.W = C.C.W + C.C.R

Cardiac cost of work (C.C.W) = AHR1 x Duration

(AHR_1 = Average working – Average Resting heart rate)

Cardiac cost of rest (C.C.R) = AHR_2 x Duration

(AHR_2 = Average Recovery – Average resting heart rate)

Total cardiac cost of work (T.C.C.W) was analyzed and reported in table 4.14.

Digging of land

It was observed that while digging of land by women farmers with the help of traditional technology, mean T.C.CW was 983.33 beats. Whereas T.C.C.W in replication one, two and three were 982.33 beat, 985.50 and 982.33 beats respectively.

While digging of land by women farmers with the help of modified technology, T.C.C.W in replication one, two and three were 957.66 beats, 961.33 beats and 962.50 beats. Mean T.C.C.W was 960.49 beats while digging of land with the help of traditional technology, T.C.C.W was more i.e. 22.84 (beats) as compared to modified technology(table,4.14)

Table 4.14. T.C.C.W (beats) of Women Farmer During Activities with Traditional and Modified Technology.

S.No.	Activities	Av.T.C.C.W	TCCW1	TCCW2	TCCW3
1.	**Digging of land**				
(a)	Traditional	983.33	982.33	985.50	982.33
(b)	Modified	960.49	957.66	961.33	959.82
	Difference	± 22.84	± 24.67	± 24.17	± 22.503
2.	**Levelling of land**				
(a)	Traditional	637.67	635.50	638.00	637.05
(b)	Modified	621.00	617.00	619.33	619.11
	Difference	± 16.67	± 18.50	± 18.67	± 17.94
3.	**Application of manure**				
(a)	Traditional	655.60	647.19	659.33	654.04
(b)	Modified	635.60	636.16	635.50	635.16
	Difference	± 20.00	± 11.03	± 23.83	± 18.88
4.	**Sowing**				
(a)	Traditional	633.31	633.66	633.00	633.33
(b)	Modified	701.33	695.66	701.00	699.33
	Difference	± 68.02	± 61.34	± 68.0	± 66.00
5.	**Interculture**				
(a)	Traditional	764.00	762.66	765.00	764.00
(b)	Modified	741.33	745.00	742.00	742.76
	Difference	± 22.67	± 17.66	± 23.00	± 21.22
6.	**Hoeing**				
(a)	Traditional	772.44	771.83	773.00	772.50
(b)	Modified	752.33	750.66	755.00	752.66
	Difference	± 20.11	± 21.17	± 18.0	± 19.83
7.	**Weeding**				
(a)	Traditional	762.82	763.16	762.16	763.16
(b)	Modified	739.00	741.00	745.00	741.66
	Difference	± 23.82	± 22.16	± 17.169	± 21.49

Table 4.14 Cont...

Table 4.14Cont...

8.	**Harvesting**				
(a)	Traditional	722.58	722.50	722.66	722.60
(b)	Modified	701.59	705.03	706.11	704.33
	Difference	± 20.99	± 17.50	± 16.55	± 18.36
9.	**Threshing**				
(a)	Traditional	611.276	610.33	610.00	611.50
(b)	Modified	599.33	591.00	590.66	593.66
	Difference	± 11.946	± 19.33	± 19.34	± 17.83
10.	**Winnowing**				
(a)	Traditional	593.99	593.83	593.83	594.33
(b)	Modified	580.00	578.33	575.00	577.77
	Difference	± 13.99	± 15.5	± 18.83	± 16.55

Levelling of land

It was found that when levelling of land by women farmers with the help of traditional technology, mean T.C.C.W was 637.67 beats whereas T.C.C.W in replication one, two and three were 635.50 beats, 638.00 beats and 639.33 beats respectively.

It was examined that while levelling of land with the help of modified technology, T.C.C.W in replication one, two and three were 586.83 beats, 587.83 beats and 587.50 beats respectively. Mean T.C.C.W was 637.67 beats.

Application of manure

It was observed that when application of manure in the field with the help of traditional method, means T.C.C.W in this activity was 745.60 beats. It was also observed that mean T.C.C.W in replication one, two and three were 745.66 beats, 745.83 beats and 745.33 beats respectively.

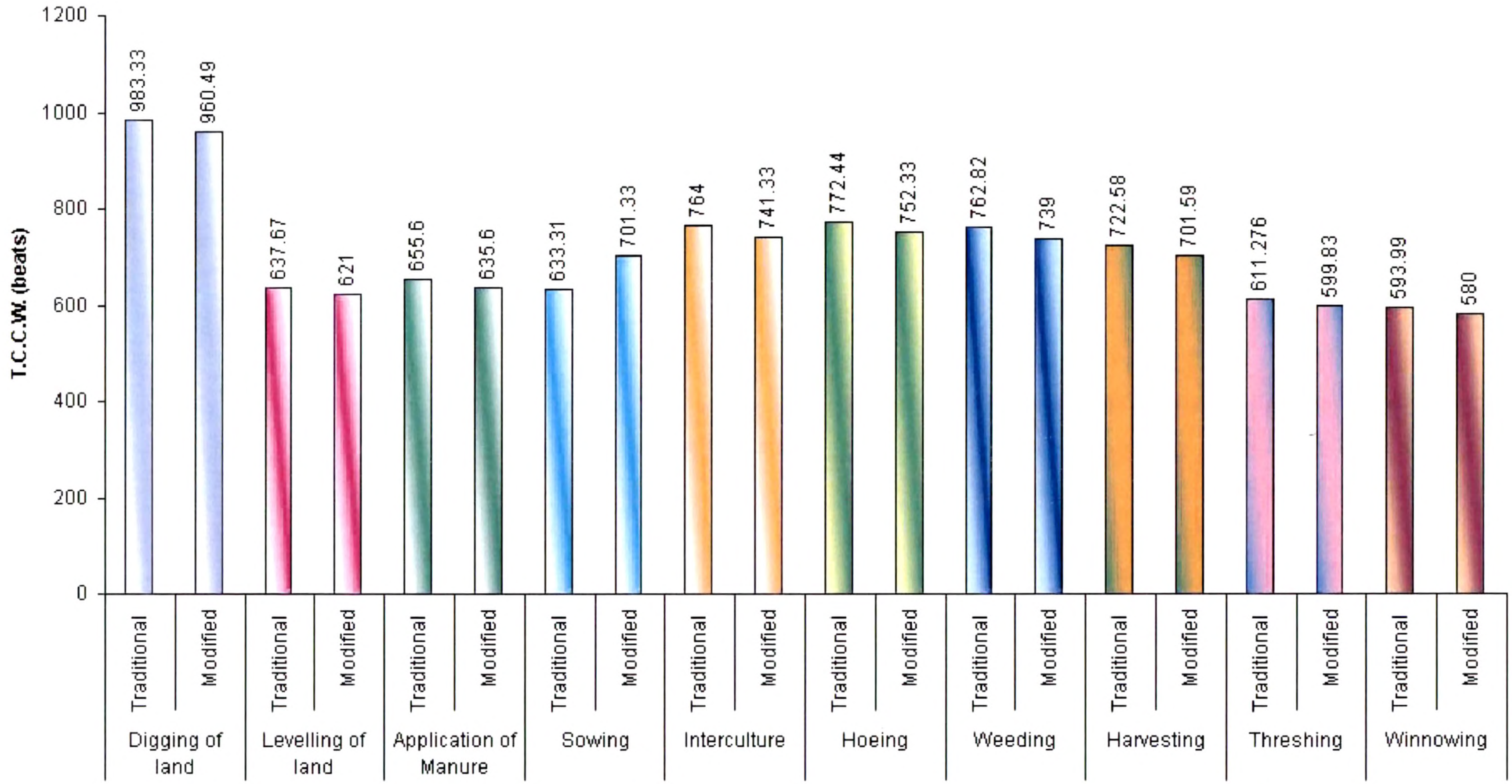


Fig 4.13 Total Cardiac Cost of Work (beats) of Women Farmers During Activities with Traditional and Modified Technologies

It as found that while application of manure in the field with the help of modified technology, mean T.C.C.W in replication one, two and three were 636.16 beats, 635.50 beats and 635.16 beats respectively. Mean T.C.C.W during this activity was 745.60.

It was found that mean T.C.C.W during application of manure in the field with the help of traditional technology was more as compared i.e. 20.00 beats to modified technology.

Sowing

When sowing was done in the field by women farmers with the help of traditional method, T.C.C.W during sowing was 633.31 beats T.C.C.W in replication one, two and three were 633.66 beats, 633.00 beats and 633.33 beats respectively.

It was noted that while sowing of seed was done in the field by women farmers with the help of modified technology, mean T.C.C.W was 787.44 beats. During this activity T.C.C.W in replication one, two and three were 787.66 beats, 786.16 beats and 788.50 beats respectively.

It was examined that mean T.C.C.W during sowing of seed in the field with the help of modified technology was more i.e. 68.02 beats as compared with the help of traditional technology.

Interculture

It was found that the activity of interculture was done with the help of traditional technology mean T.C.C.W was 764.00 beats. During the activity T.C.C.W in replication one, two and three were 762.66 beats, 765.00 beats and 764.00 beats respectively.

It was observed that when activity of interculture was done with the help of modified technology, mean T.C.C.W was 629.00 beats. About 629.83 beats, 630.50 beats and 629.66 beats were T.C.C.W in replication one, two and three respectively during the activity of interculture.

It was found that T.C.C.W was more during the activity of interculture was done with the help of traditional technology as compared to modified technology. (Table 4.14)

Hoeing

Mean T.C.C.W was 772.44 beats when hoeing was done with the help of traditional technologies. T.C.C.W during replication one, two and three were 771.83 beats, 773.0 beats and 772.5 beats.

It was noted that mean T.C.C.W was done with the help of modified technologies T.C.C.W during replication one, two and three were 665.16 beats, 666.0 beats and 667.5 beats respectively.

It was thus concluded that T.C.C.W was less i.e. 20.11 beats during the activity of hoeing was done with the help of modified technology as compared to traditional technology.

Weeding

It was observed that when activity of weeding was done with the help of traditional technology, mean T.C.C.W was 762.82 beats. About 763.16 beats, 762.16 beats and 660.83 beats T.C.C.W in replication one, two and three respectively.

While weeding was done with the help of modified technology, mean T.C.C.W was 659.83 beats. During this activity T.C.C.W in replication one, two and three were 659.16 beats, 659.50 beats and 660.83 beats respectively.

It was noted that mean T.C.C.W during weeding with the help of modified technology was less i.e. 23.82 beats as compared with the help of traditional technology.

Harvesting

It was found that when activity of harvesting was done with the help of traditional technology, mean T.C.C.W was 722.58 beats. T.C.C.W in replication one, two and three were 722.5 beats, 722.66 beats and 722.60 beats respectively.

While activity of harvesting was done with the help of modified technology, mean T.C.C.W was 622.27 beats. About 621.83 beats, 622.33 beats and 622.66 beats of T.C.C.W during the activity of harvesting with the help of modified technology.

It was noted that mean T.C.C.W during harvesting with the help of modified technology was less i.e. 20.99 beats as compared to traditional technology.

Threshing

It was observed that while activity of threshing was done with the help of traditional method means T.C.C.W was 611.276 beats, whereas T.C.C.W in replication one, two and three were 610.33 beats, 610.00 beats and 611.50 beats respectively.

When activity of threshing was done with the help of modified technology, mean T.C.C.W was 585.05 beats. During replication of one, two and three T.C.C.W were 585.16 beats, 584.16 beats and 585.83 beats which was less i.e. 11.946 beats as compared to traditional technology.

Winnowing

During the activity of winnowing by women farmers with the help of traditional technology T.C.C.W was 593.94 beats, whereas in replication one, two and three T.C.C.W were 593.33 beats, 593.83 beats and 594.33 beats respectively.

While activity of winnowing was done with the help of modified technology, mean T.C.C.W was 523.608 beats. During replication one, two and three T.C.C.W were 523.83 beats, 523.83 beats and 523.66 beats respectively which was less i.e. 18.99 beats as compare to traditional technology.

Thus, from the overall analysis it can be concluded t hat overall total cardiac cost of work was more with traditional technologies as compared to modified technologies, it can be concluded that modified technologies were more suitable to the women farmers.

Muscular Stress (Grip Strength) of Women Farmers During Activities with Traditional and Modified Technology

Greater part of the population working on Indian farmers use work methods / tools / equipments for performing agricultural task such as primary and secondary tillage, sowing, weeding, harvesting and threshing which depends either partly or completely on human muscle power, and mechanical efficiency of the human body together with the conditions which modify and control them.

Each muscle fibre contracts with a certain force and the strength of the whole muscle is the sum of these muscle fibres. The maximum strength of a human muscle lies between 3 and 4 kg / cm^2 of the cross – section, thus a muscle 1 cm^2 cross – section, thus a muscle of 1cm^2 cross section, thus a muscle of 1 cm^2 cross section can support a weight of 3 – 4 kg (Grandjean 1979).

The number of activity contracting muscle fibres determines how power is developed during the period of contraction. A muscle fibre is made to contract by incoming nervous impulses, hence the amount of muscle power produced is determined by the number of nervous impulses. That is by the number of motor nerve cells in the brain that have been excited. The speed of a muscular contraction depends upon how quickly power is developed during a given interval of time, so the rapidity of a movement is governed by the number of activity contracting muscle fibers

The strength parameters important in agricultural machinery operations are hands, grip strength, push and pull strength and elbow flexion and extension strength and leg strength and foot strength. Almost no data on these aspects are available for female as well as male workers. However, it is generally considered that a woman has about 2/3 strength as that of man. (Grandjean 1979).

Women farmers in agriculture field perform manual activities i.e. digging of land, levelling of land, sowing, weeding, harvesting, threshing and winnowing. Muscular stress was prominent among these activities. Therefore, an attempt was made to measure the muscular stress (Grip strength) of women farmers while performing various organic farming activities. The data (Table 4.15) is presented under following sub heading.

Digging of land

When digging of land was done with the help of traditional technology, mean muscular stress (grip strength) of right and left hands before activity were 18.305 kg and 15.08 kg respectively. Mean muscular stress of both hands during activity were 14.67 kg and 12.54 kg(rigt and left) respectively. Mean difference in muscular of both right and left hand were 3.63 kg and 2.505 kg respectively. Percentage increase in muscular stress of both hand were 19.83 for right and 16.84 left.

It was found that while digging of land was done with the help of modified technology, mean muscular stress of right and left hand before activity were 18.290 kg and 15.04 kg respectively. Mean muscular stress of both hand during activity were 15.05 kg and 12.98 kg respectively. Mean difference and percentage increase in muscules stress of both (right and left) hands were 3.24 kg, 2.06 kg, 17.71percent and 13.69 percent respectively.

Levelling of land

While levelling of land with the help of traditional method, mean muscular stress of both hand (right and left) before activity were 16.88 kg and 13.43 kg respectively. Mean muscular stress of both hands during activity were 14.29 kg and 13.43 kg respectively. Mean difference and percentage increase in muscular stress of both hands were 2.58 kg, 0.13 kg, 15.31 and 13.71 respectively.

It was observed that mean difference and percentage increase in muscular stress of both hands were more while activity was done with the help of traditional technology.

It was noted that while levelling of land with the help of modified technology, mean muscular stress of both hands before and during activity were 16.67 kg, 15.62 kg, 14.52 kg and 14.08 kg respectively. Mean difference in muscular stress of both hands were 2.15 kg and 1.540 kg respectively. Percentage increases in muscular stress of both (right and left) hands were 12.89 and 9.85 respectively.

It was observed that while levelling of land with the help of modified technology, mean difference and percentage increase in muscular stress of both hands (right and left) were less.

Table 4.15. Muscular Stress (Grip Strength) of Women Farmers During Activities with Traditional and Modified Technology.

S.No.	Activities	Right Hand				Left hand			
		M.S. (Kg) before activity	M.S. (Kg) before activity	Mean Difference in M S. (kg)	% increase in M.S.	M.S. (Kg) before activity	M.S. (Kg) before activity	Mean Difference in M.S. (kg)	% increase in M.S.
1	**Digging of land**								
(a)	Traditional	18.305	14.67	3.63	19 83	15.108	12.54	2.501	16.84
(b)	Modified	18 29	15.05	3 24	17 71	15.05	12 98	2.06	13.69
	Difference	±0 015	±0 38	±0.39	±2 12	±0 04	±0.44	±0.44	±3.15
2	**Levelling of land**								
(a)	Traditional	16.88	14.29	2.585	15.31	15.575	13.43	2.136	13.71
(b)	Modified	16.67	15.42	2 15	12.89	15.620	14.08	1.54	9.85
	Difference	±0.21	±0.23	±0.435	±2.42	±0.045	±0.65	±0.596	±3.86
3	**Application of manure**								
(a)	Traditional	18.57	16.34	2.11	11.36	14.875	13.095	1.78	11.96
(b)	Modified	18.6	17.10	1.5	8.06	14.73	13.58	1.15	7.80
	Difference	±0.03	±0.76	±0.61	±3.3	±0.143	±0.485	±0.63	±4.16
4	**Sowing**								
(a)	Traditional	18.5	16.94	1.59	8.59	15.04	13.61	1.42	9.44
(b)	Modified	18.59	16.67	1.91	10.27	15.18	13.67	1.51	9.94
	Difference	±0.09	±0.27	±0.32	±1.7	±0.14	±0.06	±0.09	±0.5
5	**Interculture**								
(a)	Traditional	19	16.6	2.4	12 63	15.05	13.665	1.385	9.2
(b)	Modified	18.51	17.31	1.196	6.46	15.23	14.25	0.98	6.43
	Difference	±0.49	±0 71	±1.204	±6 17	±0.18	±0.446	±0.30	±2.08
6	**Hoeing**								
(a)	Traditional	18.36	14.73	3.63	19.77	15.285	13.07	2.215	14.51
(b)	Modified	18.37	15.68	2.69	14.64	15.670	13.69	1.88	12.07
	Difference	±0.01	±0.95	±0.94	±5.13	±0.31	±0.62	±0.335	±2.44
7	**Weeding**								
(a)	Traditional	18.03	13.65	4.375	24.26	14.42	12.85	3.56	24.68
(b)	Modified	17.99	14.29	3.7	20.56	14.88	12.25	2.63	17.67
	Difference	±0.04	±0.64	±0.675	±3 7	±0.46	±0.6	±0.93	±7.01

Table 4.15 Cont. .

Table 4.15 Cont...

8	**Harvesting**								
(a)	Traditional	17.7	13.99	3.71	20.96	14.93	12.025	2.905	19.45
(b)	Modified	17.81	14.85	2.96	16.61	15.36	12.69	2 67	17.38
	Difference	±0 11	±0.86	±0.75	±4.35	±0.43	±0.665	±0.235	±2.07
9	**Threshing**								
(a)	Traditional	18.47	13.17	5.3	28.69	17.61	13.39	4.21	23.96
(b)	Modified	18 14	14.27	3.86	21.13	17.66	14.47	3.19	18.06
	Difference	±0 33	±1.1	±1.43	±7.56	±0.05	±1.11	±1.03	±5.90
10	**Winnowing**								
(a)	Traditional	18.03	15.58	2.27	12.63	13.36	11.79	1.88	14.07
(b)	Modified	18	16.64	1.55	8.61	14.00	12.41	1.59	11.21
	Difference	±0.025	±1.06	±0.72	±4.02	±0.64	±0.62	±0.29	±2.86

Difference in grip strength = Grip strength before activity – Grip strength after activity.

$$\% \text{ increase in grip strength} = \frac{\text{Grip strength before activity - Grip strength after activity}}{\text{Grip strength before activity}}$$

Applications of manure

It was observed that when application of manure in the field with the help of traditional method, mean muscular stress of both hand during and before activity were 18.57 kg, 14.875 kg, 16.34 kg and 13.095 kg respectively. Mean difference in muscular stress of both hands were 2.11 kg and 1.78 kg respectively. Percentage increase in muscular stress of both (right and left) hands were 8.06 kg and 7.80 respectively.

It was noted that while application of manure in the field with the help of traditional technology, mean difference and percentage increase in muscular stress of both hands were, more as compared to modified technology.

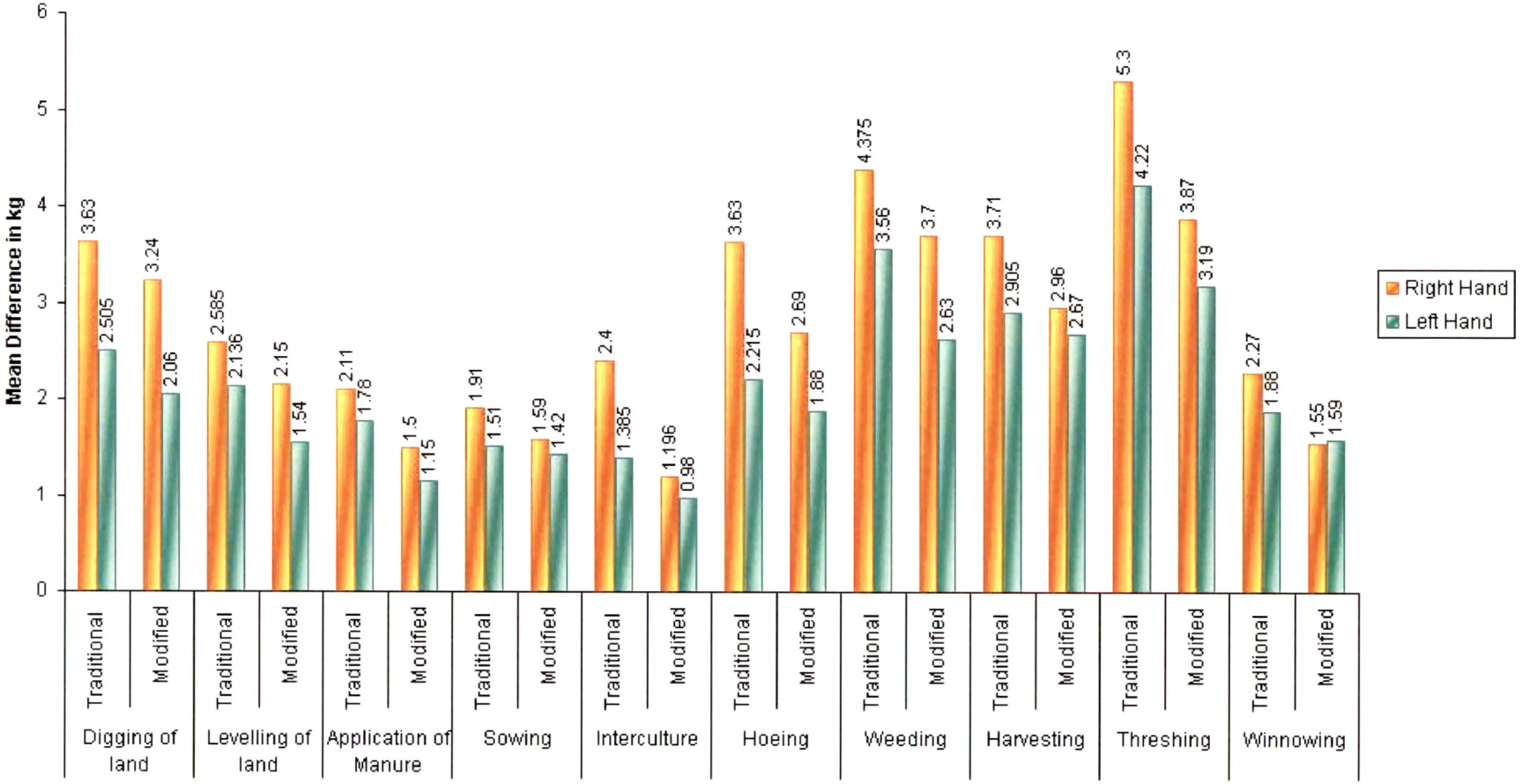


Fig. 4.14 Mean Difference in Muscular Stress (grip strength) of Women Farmers During Activities with Traditional and Modified Technology

Sowing

Mean muscular stress of both hand before and during the activity of sowing with the help of modified technology were 13.59 kg, 15.18 kg, 16.67 kg and 13.67 kg, respectively, I was noted that activity of sowing was done with the help of traditional technology mean difference in muscular stress of both hands(right and left) were 1.91 kg and 1.51 kg, respectively.

It was noted that while sowing of seed in the field by women farmers with the help of traditional method, mean muscular stress of both (right and left) hands before and after the activity were 18.50 kg, 15.04 kg, 16.94 kg and 13.61 kg respectively. Mean difference and percentage increase in muscular stress were ± 0.32 kg, ± 0.09 kg, ± 1.70 and ± 0.5 respectively.

It was examined that muscular stress was more while performing the activity of modified technology as compared to traditional technology.

Interculture:

It was found that the activity of interculture was done with the help of traditional technology mean muscular stress of both hands (right and left), before and after activity were 19.00 kg, 15.05 kg, 16.60 kg, and 13.665 kg, respectively. Mean difference in muscular stress of both hands were 2.40 kg and 1.385 kg, respectively. Percentage increase in muscular stress of both (right and left) hands was12.63 and 9.20 respectively.

It was observed that when activity of interculture was done with the help of modified technology mean muscular stress of both hands (right and left) before and during activity were 18.51 kg, 15.23 kg, 17.31 kg and 14.110 kg, respectively it was also found that mean difference and percentage increase in muscular stress of both hands were 1.196 kg , 0.980 kg ,6.46 percent and 6.43 percent. It was found tat during interculture with te help of modified

technologies muscular stress of bot hands were less as compared to traditional technologies.

Hoeing

Mean muscular stress of both (right and left) hands before and during the activity of hoeing with the help of traditional technology were 13.36 kg, 15.285 kg, 14.73 kg and 13.07 kg respectively. It was examined that mean difference in muscular stress of both hand were 3.63 kg and 2.215 kg, respectively. Percentage increase in muscular stress after hoeing 19.77 and 14.51 respectively.

During the activity of hoeing with the help of modified technology, mean muscular stress of both hands (right and left) before and after activity were 18.87 kg, 15.570 kg, 15.68 kg and 13.69 kg, respectively. During the activity of hoeing with modified technology mean difference in muscular stress of both hands were 2.69 kg and 1.88 kg respectively. Percentage increases in muscular stress of both hands were 14.64 and 12.07 respectively.

It was observed that while hoeing was done with the help of traditional technology, mean difference and percentage increase in muscular stress of both hands was more as compared to modified technology.

Weeding

It was found that when activity of weeding was done with the help of traditional technology, mean muscular stress of both hands (right and left) before and after activity were 18.03 kg, 14.42 kg, 13.65 kg and 12.85 kg, respectively. Mean difference and Percentage increase in muscular stress of both hands were 4.375 kg, 3.56 kg, 24.26 and 24.68, respectively.

It was found that while weeding was done with the help of modified technology, mean muscular stress of both (right and left) hands before and after

activity were 17.99 kg, 14.88 kg, 14.29 kg and 12.25 kg respectively. Mean difference in muscular stress of both hands were 3.70 kg and 2.63 kg, respectively. Percentage increases in muscular stress of both hands were 20.56 and 17.67 respectively.

It was noted that while activity of weeding was done with the help of modified technology mean difference and percentage increase in muscular stress of both hands were lower.

Harvesting

During the activity of harvesting by women farmers with the help of traditional technology, mean muscular stress of both hands (right and left) before and after activity were 17.70 kg, 14.93 kg, 13.99 kg and 12.095 kg respectively. Mean difference in muscular stress of both hands were 3.71 kg and 2.905 kg respectively.

While activity of harvesting was done with the help of modified technology, means muscular stress of both hands (right and left) before and after activity were 17.81 kg, 15.26 kg, 14.85 kg and 12.69 kg, respectively. Mean difference and percentage increase in muscular stress of both were 2.96 kg, 2.67 kg 16.61 kg and 17.38 kg, respectively.

It was observed that while activity, of harvesting was done with the help of traditional technology, mean difference and percentage increase in muscular difference of both hands were more as compared to modified technology.

Threshing

It was found that when activity of threshing was done with the help of traditional method , mean muscular stress of both hands before and after activity were 18.47 kg, 17.61 kg, 13.17 kg and 13.36 kg, respectively. Mean difference in muscular stress of both (right and left) hands were 5.30 kg and

4.22 kg respectively. It was also found that percentage increase in muscular stress of both hands 20.96 and 19.45 respectively.

It was observed that while threshing was done with the help of modified technology, mean muscular stress of both hands before and after activity were 18.14 kg, 17.66 kg, 14.27 kg and 14.47 kg, respectively. Mean difference and percentage increase in muscular stress of both hands were, 3.67 kg, 3.119 kg 21.13 and 18.06, respectively.

It was found that when activity of threshing was done with the help of modified technology, mean difference and percentage increase in muscular stress were less respectively.

Winnowing

During the activity of winnowing by women farmers with the help of traditional method, mean muscular stress of both (right and left) hands before and during activities were 18.025 kg, 13.36 kg, 15.58 kg and 11.79 kg respectively. Mean difference in muscular stress of both hands were 2.27 kg and 1.88 kg, respectively.

While activity of winnowing was done with the help of modified technology. Mean muscular stress of both hands (right and left) before and during winnowing were 18.00 kg, 14.005 kg, 16.64 kg and 12.41 kg, respectively. Mean difference and percentage increase in muscular stress of both hands were 1.55 kg, 1.59 kg, 8.61, and 11.21 respectively.

It was noted that during the activity of winnowing with the help of traditional technology means difference and percentage increase in muscular stress of both hands were more.

For the present study muscular stress of women farmers was recorded before and after work in various agricultural activities. It was observed that muscular stress increased after the activity. It was also found that muscular stress of both hands was greater when various activities were was performed with the help of traditional technologies as compared to modified technology. Muscular stress of both (right and left) hand was highest during threshing, weeding, harvesting digging of land and hoeing with the help of traditional technologyand modified technology also.It was lowest in sowing, interculture, application of mannuring, levelling of land, and winnowing with the help of traditional technologyand modified technologies also.

Thus, from the experiments that were carried out it was concluded that, modified technologies were more suitable to the women farmers as compared to traditional technologies. Because muscular stress was less with modified technologies and they could work for longer hours without much muscular stress.

Postural Stress of Women Farmer During Activities with the help of Traditional and Modified technologies

A good posture is one, which can sustain a minimum of static effort and which allows the subject to perform the given task more effectively and with least muscular stress. Nag et al (1980) observed the weeding either in squatting or bending posture did not cause a marked difference in energy expenditure (i.e., 11.20 kJ/min and 12.18 kJ/min, respectively). But the drudgery caused due to bending is reflected in terms of postural discomfort experienced by the workers. Considering this aspect, they suggested use of long handled tools to avoid the bending posture during work (Cited in, Tewari 2002).

There is a positive relation in the angle of body movements, musculoskeletal problems and energy expenditure have shown that the more

the trunk in inclined forward the higher were stress values at the lumbo-sacral joint.

Digging of land

I was observed that when women farmers were digging the land with the help of traditional technology, mean angle of normal curve were 211.5 degree in upper and 198.66 degree in lower portion. During the activity with the help of traditional technology angle while bending were 217.95 degree in upper and 203.3 degree in lower portion. Mean angle of deviation in upper and lower portion were 6.45 degree and 4.64 degree, respectively.

When activity digging of land was done with modified technology, angle of normal curve was same and angle during activity were different upper and lower portion i.e. 214.1 degree and 199.93 degree, respectively. During the activity mean angle of deviation was 2.60 degree in upper portion and 1.27 degree in lower portion.

It was found that when activity digging of land was done with the help of traditional technology, angle of deviation were more in the lower portion as compared to modified technology.

Levelling of land

During levelling of land with the help of traditional technology, angle of normal curve was 211.5 degree in upper portion and 198.66 degree in lower portion. Angle while bending were 216.25 degree in upper portion and 204.33 degree in lower portion, while levelling of land was done with the help of traditional technology, angle of deviation in upper and lower portion were 4.75 degree and 5.67 degree respectively.

It was noted that when levelling of land by women farmers with the help of modified technology, angle of normal curve was same, and angle during activity of upper and lower portion were 213.48 degree and 209.85 degree,

respectively. Angle of deviation in upper and lower portion during the activity was 2.25 degree and 1.34 degree, respectively.

It was observed that when activity levelling of land was done with the help of modified technology, angle of deviation in upper and lower portion were less as compared to traditional technology.

Application of manure

If angle of normal curve were 211.5 degree and 198.66 degree in upper and lower portion respectively when application of manure in the field with the help of traditional method was carried out, angle of deviation in upper and lower portion were 213.96 degree and 200.20 degree, respectively. Angle of deviation was found in upper and lower portion were 2.46 degree and 1.54 degree, respectively.

When manure was applied in field by women farmers with the help of modified technologies, angle while bending in upper and lower portion 213.21 degree and200.03 degree, respectively while normal curve were 211.5 degree and 198.66 degree in upper and lower portion respectively. Angle of deviation was 1.71 degree in upper portion and 1.37 degree in lower portion.

It was found that while activity was performed with the help of modified technology, angle of deviation were less as compared to traditional method.

Table: 4.16 Postural Stress (angle of deviation) of Women Farmer during Activities with Traditional and Modified Technologies.

S.N.	Activities	Angle of normal curve (°)		Angle while bending (°)		Angle of Deviation (°)	
		U	L	U	L	U	L
1.	**Digging of land**						
(a)	Traditional	211.5	198.66	217.95	203.3	6.45	4.64
(b)	Modified	211.5	198.66	214.1	199.93	2.60	1.27
(c)	Difference	-	-	±3.85	±3.87	±3.85	±3.37
2.	**Levelling of land**						
(a)	Traditional	211.5	198.66	216.25	204.33	4.75	5.67
(b)	Modified	211.5	198.66	213.48	201.85	2.25	3.25
(c)	Difference	-	-	±2.77	±2.48	±2.50	±2.42
3.	**Application of manure**						
(a)	Traditional	211.5	198.66	213.96	200.20	2.46	1.54
(b)	Modified	211.5	198.66	213.21	200.03	1.71	1.37
(c)	Difference	-	-	±0.75	±0.17	±0.75	±0.17
4.	**Sowing**						
(a)	Traditional	211.5	198.66	219.05	201.78	7.55	3.12
(b)	Modified	211.5	198.66	212.9	199.98	1.40	1.32
(c)	Difference	-	-	±0.75	±1.80	±6.15	±1.80
5.	**Interculture**						
(a)	Traditional	211.5	198.66	217.55	203.86	6.05	5.20
(b)	Modified	211.5	198.66	214.76	201.88	3.26	3.22
(c)	Difference	-	-	±2.79	±1.98	±2.79	±1.98
6.	**Hoeing**						
(a)	Traditional	211.5	198.66	218.08	202.43	6.58	3.77
(b)	Modified	211.5	198.66	204.65	200.05	3.55	1.39
(c)	Difference	-	-	±4.43	±2.38	±3.43	±2.38
7.	**Weeding**						
(a)	Traditional	211.5	198.66	216.46	203.31	4.96	4.65
(b)	Modified	211.5	198.66	212.71	202.06	3.70	3.4
(c)	Difference	-	-	±4.36	±1.25	±1.26	±1.25

Table 4.16 Cont...

Table 4.16 Cont...

8.	**Harvesting**						
(a)	Traditional	211.5	198 66	216.58	203.36	5.08	4.7
(b)	Modified	211.5	198.66	216.26	203.06	4.76	4.4
(c)	Difference	-	-	±0.32	±0.30	±0.32	±0.3
9.	**Threshing**						
(a)	Traditional	211.5	198.66	214.4	203.18	4.96	4.52
(b)	Modified	211.5	198.66	216.05	202.93	4.55	4.27
(c)	Difference	-	-	±1.65	±0.25	±0.35	±0.25
10.	**Winnowing**						
(a)	Traditional	211.5	198.66	216.31	202.7	4.80	4.04
(b)	Modified	211.5	198.66	216.11	202.48	4.61	3.32
(c)	Difference	-	-	±0.20	±0.22	±0.19	±0.22

U = Upper back

L = Lower back

Angle of Deviation = Angle while bending - Angle of normal curve.

Sowing

While sowing of seed in field by women farmers with the help of traditional method, angle while bending and 201.78 degree, respectively, while angle of normal curve were 211.5 degree in upper portion and 198.66 degree in lower portion. Angle was 7.55 degree and 3.12 degree, respectively.

It was noted that while activity of sowing of seed was done in the field by women farmers with the help of modified technology, angle during working in upper and lower portion were 212.9 degree and 199.98 degree, respectively, where as angle of normal curve in upper and lower portion were 211.5 degree and 198.66 degree, respectively.

It was observed that when activity of sowing was done with the help of modified technology, angle of deviation was less as compared to traditional technology.

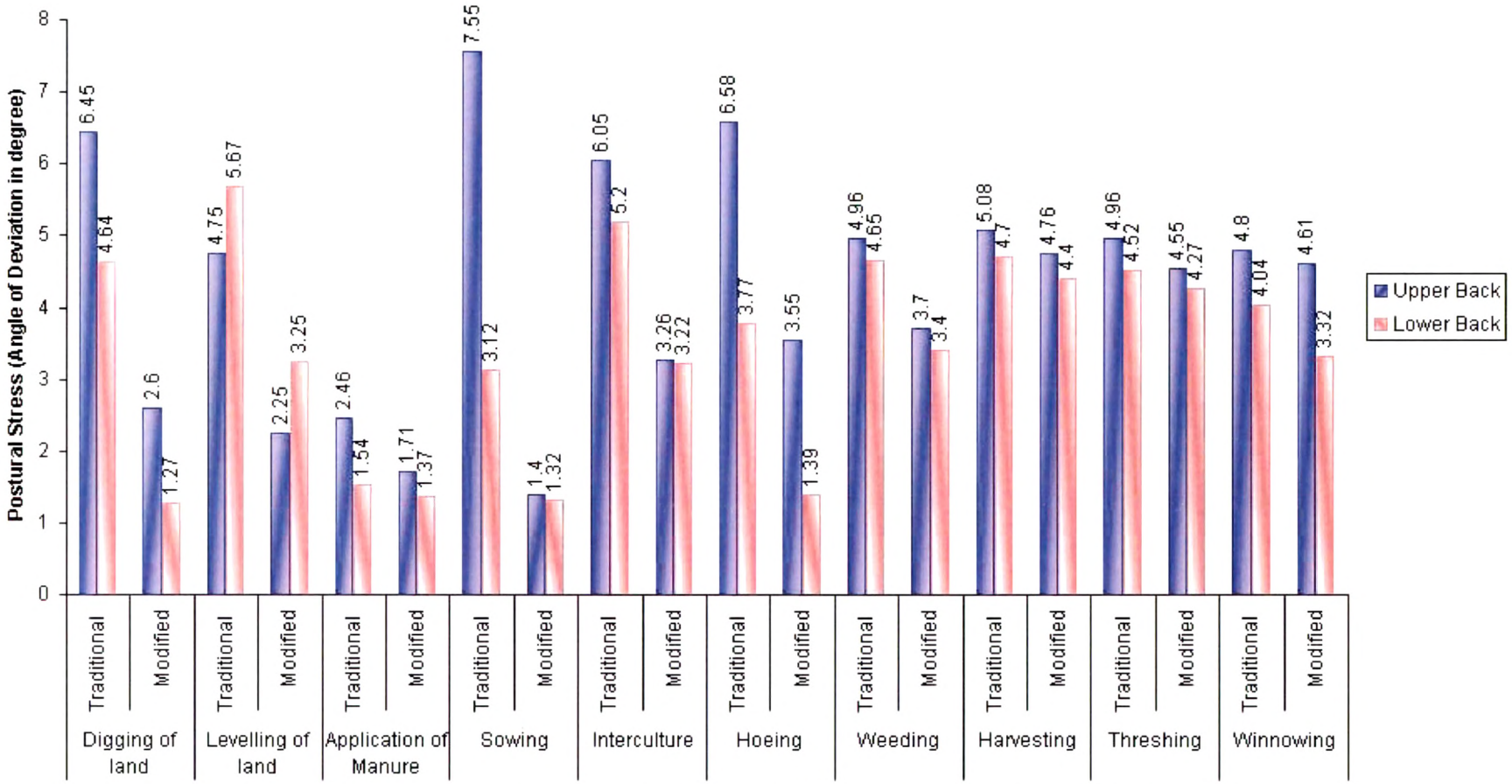


Fig 4.15 Postural Stress (Angle of Deviation) of Women Farmers During Activities with Traditional and Modified Technologies

Interculture

It was examined that while the activity of interculture was done with the help of traditional technology, angle while blending in upper and lower portion were 217.55 degree and 203.86 degree, respectively, whereas angle of normal curve were 211.5 degree in upper portion and 193.66 degree, respectively. Angle of deviation was in upper and lower portion were 6.05 degree and 5.20 degree respectively.

It was found that angle of normal curve in upper and lower portion were 211.5 degree and 198.66 degree, respectively, while interculture was done with the help of modified technology angle while working condition was in upper and lower portion were 214.76 degree and 200.28 degree respectively. Angle of deviation in upper and lower portion was 3.26 degree and 1.62 degree respectively.

It was observed that when activity of interculture was done with the help of traditional technology, angle of deviation were more respectively.

Hoeing

Angle of normal curve were 211.5 degree in upper portion and 198.66 degree in lower portion whereas hoeing was done with the help of traditional technology angle while bending in upper and lower portion were 218.08 degree and 202.43 degree, respectively. Angle of deviation was 6.58 degree and 3.77 degree in upper and lower portion respectively.

It was noted that while hoeing was done with the help of modified technology, angle of deviation while activity were 213.65 degree in upper portion and 203.06 degree in lower portion, respectively. Angle of deviation in upper and lower portion 2.15 degree and 1.39 degree, respectively.

It was observed that while activity of hoeing was done with the help of traditional technology, angle of deviation were more as compared to modified technology.

Weeding

It was examined that when activity of weeding was done with the help of traditional technology angle while working in upper and lower portion 216.46 degree and 203.31 degree, respectively, whereas angle of normal curve in upper and lower portion were 211.5 degree and 198.66 degree, respectively. Angle of deviation in upper and lower portion was 4.96 degree and 4.65 degree respectively.

It was noted that while weeding was done with the help of modified technology, angle while working was 212.71 degree in upper and 202.06 degree in lower portion, whereas angle of normal curve in upper and lower portion were 211.5 degree and 198.66 degree, respectively. Angle of deviation in upper and lower were 3.70 degree and 3.4 degree, respectively.

It was observed that while activity of weeding was done with the help of modified technology, angle of deviation were less as compared to traditional technology.

Harvesting

While the activity of harvesting was done by women farmers with the help of traditional technologies, angle while bending in upper and lower portion were 216.58 degree and 203.86 degree, respectively. Whereas angle of normal curve in upper and lower portion 211.5 degree and 198.66 degree, respectively.Angle of deviation were 5.08 degree in upper portion and 4.7 degree in lower portion.

It was found that when activity harvesting was done with the help of modified technology, angle of normal curve were 211.5 degree in upper portion and 198.66 degree in lower portion, whereas during activity angle in upper and lower portion were 216 26 degree and 203.06 degree, respectively. Angle of deviation was 4.76 degree in upper portion and 4.4 degree in lower portion.

It was examined that during the activity of harvesting was done with the help of traditional technology, angle of deviation in upper and lower portion were more.

Threshing

During the activity of threshing was done with the help of traditional method, angle of normal curve in upper and lower portion were 211.5 degree and 203.36 degree, respectively, while angle during the threshing in upper and lower were 214.4 degree and 203.18 degree respectively. Angle of deviation was 4.90 degree and 4.52 degree in upper and lower portion, respectively.

It was noted that while threshing was done with the help modified technology, angle while bending 214.4 degree and 208.18 degree in upper and lower portion respectively, whereas angle of normal curve was same. Angle of deviation upper and lower portion was 4.76 degree and 4.4 degree respectively.

It was found that while threshing was done with the help of modified technology, angle of deviation in upper and lower portion were less as compared to traditional method.

Winnowing

During the activity of winnowing by women farmers with the help of traditional method, angle while working in upper and lower were 216.31 degree and 202.7 degree, respectively, whereas angle of normal curve were

211.5 in upper portion and 198.66 in lower portion. Angle of deviation was 4.80 degree and 4.04 degree in upper and lower portion, respectively.

While the activity of winnowing was done with the help of modified technology, angle while bending were 216.11 degree and 202.48 degree in upper and lower portion, respectively, whereas angle of normal curve were same while performing the activity with traditional technology.

It was observed that when activity of winnowing was done with the help of traditional technology, angles of deviation were more as compared to modified method.

From the findings of the present study it was observed that postural stress (angle of deviation) during digging of land, hoeing, levelling of land, interculture and weeding with the help traditional activities were more among all activities, while various agricultural activities were preformed with the help of traditional technologies, due to adoption of wrong body posture, the heart and lungs may be partially affected when they are crowded by a bowed back. A tilted pelvis may be the other cause of back strain and improper functional of abdominal organs caused by the poor posture. Unbalanced weight distribution, with resultant strain may produce pain in the back, legs and feet. The thorack, abdominal and pelvic organs suffer from faulty nerve supply. These shits in positions affects the organs so extensively that they could not be expected to function properly. (Grady, 1954).

Extent of activity based on physiological cost of work

Women do many of the most difficult form tasks in India, sowing, transplanting, application of manure, weeding harvesting and post-harvesting processing of production. These activities are monotonous and arduous in nature. All of these tasks are time – consuming and full of drudgery.

While collecting the experimental data of women farmers, the heart rate (beats/min), energy expenditure and total cardiac cost of work (beats) have been calculated. On the basis of these responses, various agricultural activities were classified by taking into consideration the classification of activities based on Astrand and Rodahl (1986). Most of the agricultural activities fall under the category of moderate to severe activity.

Specially digging of land with the help of traditional and modified technology was came under the category of severe activity (greater than 130 beats/min), whereas levelling of land, Application of manure, sowing, interculture, hoeing, weeding, harvesting were done with the help of traditional and modified technology, these activities fall under the category of heavy activity (110-130 beats/min) No significant difference was found when these activity was done with any type of technology (Table – 4.17.

It was observed that when threshing was done with the help of traditional technology, it was fall under the heavy activity (110 – 130 beats/min) while it was done with the modified technology it came under the moderate activity (90 – 11 beats / min).

It was examined hat while winnowing was done by women farmers with the help of traditional method, than it came under the heavy activity. During the activity of winnowing with the help of modified technology. It came under the category of moderate (90 – 110 beats/min) activity.

Table 4.17: Classification of Physical Work According to Physiological Response

SN.	Activities	Light (<90) beats/min	Moderate (90–110) beats/min	Heavy (110–130) beats/min	Severe (>130) beats/min
1.	**Digging of land**				
(a)	Traditional	-	-	-	138.66
(b)	Modified	-	-	-	134.66
2.	**Levelling of land**				
(a)	Traditional	-	-	127.62	-
(b)	Modified	-	-	125.46	-
3.	**Application of manure**				
(a)	Traditional	-	-	122.49	-
(b)	Modified	-	-	118.16	-
4.	**Sowing**				
(a)	Traditional	-	-	117.83	-
(b)	Modified	-	-	125.05	-
5.	**Interculture**				
(a)	Traditional	-	-	130.26	-
(b)	Modified	-	-	124.72	-
6.	**Hoeing**				
(a)	Traditional	-	-	133.26	-
(b)	Modified	-	-	127.83	-
7.	**Weeding**				
(a)	Traditional	-	-	122.33	-
(b)	Modified	-	-	120.90	-
8.	**Harvesting**				
(a)	Traditional	-	-	118.99	-
(b)	Modified	-	-	116.88	-
9.	**Threshing**				
(a)	Traditional	-	-	115.66	-
(b)	Modified	-	110.00	-	-
10.	**Winnowing**				
(a)	Traditional	-	-	113.37	-
(b)	Modified	-	110.00	-	-

Body Discomfort Experienced by Women Farmer while Using Traditional Technologies

Table 4.18 presents body discomfort experienced by women farmers in various organic farming activities while using traditional implements / technologies. They are discussed under following subheads·

Neck

It was observed from table 4.18 that more than half i.e., 66.66 percent women farmers had neck pain. Since women farmers have been spending long hours in bending posture during digging of land, levelling of land, sowing, hoeing, weeding and harvesting. These activities were done with the help of kudal (short handle hoe / traditional hoe) and traditional sickle.

It was observed that very few women i.e., 50.00 percent women farmers had neck ache while performing the various farming activities with the help of modified technologies. Women farmers various agricultural activities such as digging of land, levelling of land, application of manure, sowing, hoeing and weeding with help of long handle hoe, kutla, seeder, land leveler, manure spreader, etc There were difference in percentage body discomfort experienced by women farmers while performing activities with the help of modified technologies.

Shoulder

It was found that 66.66 percent women farmers had shoulder pain, due to the use of traditional technologies and adaption of bending and squatting position while performing activities.

It was noted that 83.33 percent women farmers had shoulder pain, while performing various agricultural activities with the help of modified technologies. They adopted standing and standing – cum bending body posture due to use of modified technologies.There were difference in percentage of

women farmers performed activities with the help of modified technologies and traditional technologies

Table no: 4.18 Body Discomfort Experienced by Women Farmers while Using Traditional and Modified Technology.

S. No.	Body Parts	Traditional technologies	Modified technologies
1	Neck	4 (66.66)	3 (50.00)
2	Shoulder	4 (66.66)	2 (33.33)
3	Elbow / Forearms	3 (50.00)	1 (16.66)
4	Palm / wrist	2 (33.33)	2 (33.33)
5	Back	6 (100.00)	3 (50.00)
6	Hip / thigh	4 (66.66)	1 (16.66)
7	Knee	5 (83.33)	4 (66.66)
8	Foot / Ankle	2 (33.33)	2 (33.33)
9	Lumber	6 (100.00)	4 (66.66)
10	Calf muscles	5 (83.33)	2 (33.33)

Figures in parenthesis indicate percentage

Elbow / forearm

It was noted that half women farmers i.e., 40.00 percent had Forearm pain due to the use of traditional technologies while performing the various type of farming activities.

It was found that very few of them i.e., 16.66 percent had Elbow / Forearm pain while using modified technologies. There were significant differences in percentage of women farmers while performing activities with the help of traditional technologies and modified technologies.

Palm/wrist

It was found that less than half i.e , 88.88 percent of them had severe palm pain, due to the use of traditional implements/ technologies while digging of land, levelling of land, interculture, hoeing, weeding harvesting, threshing, and winnowing.

About 33.33 percent of women farmers had palm / wrist pain while performing various activities like digging of land, levelling of land, application of manure, sowing, interculture, weeding , threshing etc. with the help of modified technologies. Percentage was less while performing these activities with the help of modified technologies.

Back

It was observed that all women farmers i.e., 100.00 percent were suffering from backache while performing the activity of digging land, levelling of land, sowing, interculture, weeding, hoeing, harvesting with the help of short handle hoe (kudal) and due to adoption of bending and squatting body posture.

About 66.66 percent of women farmers had palm / wrist pain while performing various activities like digging of land, levelling of land, application of manure, sowing, interculture, weeding , threshing etc. with the help of modified technologies. Percentage was less white performing these activities with the help of modified technologies.

Hip/Thigh pain

It was noted that 66.66 percent women farmers had severe hip / thigh pain during the activity of digging land, levelling land, sowing, harvesting, threshing and winnowing with the help of traditional technologies and adoption of squatting position.

Hip / Thigh pain was not very common among them while they performing various activities with the help of modified technologies. On the whole 16.66 percent had mild hip / thigh pain. There was significant difference in between percentage of women farmers who suffered from hip / thigh pain using traditional technologies and modified technologies.

Knee

Since women farmers have been spending long hours in squatting posture during sowing, levelling of land, weeding, harvesting, threshing and winnowing, knee pain was very common among them. On the whole majority of them i.e., 83.33 percent had severe knee pain, while performing the activity with the help of traditional technologies.

It was noted that very few of them i.e., 66.66 percent women farmers had knee pain while using modified technologies or performing various agricultural activities with the help of modified technologies. It was observed that there was difference in between percentage of women farmers who suffered from knee pain while using modified technologies and traditional technologies.

Foot / Ankle

Very few of them i.e., 33.33 percent women farmers had foot / ankle pain while performing the various farming activity with the help of traditional technologies.

Since women farmers have been spending long hours in standing and standing – cum – bending posture while they performing various activities with the help of modified technologies. About 33.33 percent women farmers had foot / ankle pain. It was noted that there wast difference in between percentage of women farmers who suffered from foot / ankle pain while using modified technologies and traditional technologies.

Lumber

Lumber pain was very severe among all women farmers i.e., 100.00 percent because they performed most of the activities in squatting and bending posture with the help of traditional technologies.

It was found that half women farmers i.e., 66.66 percent had lumber pain while performing various activities with the help of modified technologies. It was observed that there was difference in between percentage of women farmers who suffered from lumber pain while using modified technologies and traditional technologies.

Calf muscles

Calf muscles pain was also very common among women farmers. Majority of them i.e., 83.33 percent had severe calf muscles pain due the use of traditional technologies and adoption of squatting and bending position.

It was observed that 33.33 percent of them had calf muscles pain due to use of modified technologies. It was noted that there was significant difference in between percentage of women farmers who suffered from calf – muscles pain while using modified technologies and traditional technologies.

It was observed that 33.33 percent of them had calf muscles pain due to use of modified technologies. It was noted that there was significant difference in between percentage of women farmers who suffered from calf – muscles pain while using modified technologies and traditional technologies.

Extent of Body Discomfort Experienced by Women Farmers during Performing Various Agricultural Activities with Traditional and Modified Technologies.

Conceptually discomfort is a risk indicator as it uses the body's own feedback system to detect possible problems, possible sources of discomfort resulting from musculo-skeletal stress include: tension in muscles, nerves, blood vessels, ligaments and joint capsules. Compression of the some tissue, local chemical changes associated with muscles fatigue, local chemical changes related to restricted blood flow and partial ischemia, disruption of nerve condition resulting from pressure. Thus, body discomfort is a valuable variable for ergonomists to assess the physical match between worker and their work. Straker, (1999), states that, to adequately describe discomfort four aspects needs to be covered i.e., intensity, quality, location and temporal pattern. Measurement of the intensity of discomfort has usually been attempted by asking the worker to rate to intensity of discomfort on a scale commonly termed as a subjective scale. Various subjective rating scales are followed such as Borg's scale (1970), Corlett and Bishop (1976) scale and visual Analogue Discomfort (VAD) scale. For the present study VAD scale was used.

Table: - 4.19 (a) Extent ofBody Discomfort during Digging of Land with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n = 6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	3.9	
2.	Lower back	-	-	9.1
3.	Upper back	-	-	8.0
4.	Shoulder	-	4.9	-

Table 4.19 (a) Cont...

Table 4.19 (a) Cont...

5.	Thigh	-	5.0	-
6.	Knee	-	-	8.2
7.	Calf muscle	-	4.8	-
8.	Forearm	-	4.2	-
9.	Palm	-	4.0	-
10.	Foot	-	4.1	-
B	**With Modified Technologies**			
1.	Neck	2.1	-	-
2.	Lower back	-	5.0	-
3.	Upper back	-	4.3	-
4.	Shoulder	3.5	-	-
5.	Thigh	3.2	-	-
6.	Knee	-	4.5	-
7.	Calf muscle	-	4.1	-
8.	Forearm	2.5	-	-
9.	Palm	1.5	-	-
10.	Foot	-	3.9	-

Digging of Land

It was observed that while digging of land with the help of traditional technologies, women farmer were suffering form severe pain in lower back, upper back and knee and these body parts like neck, shoulder, thigh, calf muscle, forearm, palm, and foot were suffering from moderate pain. (Table – 4.19 (a))

When digging of land was done with the modified technologies. Intensity of body discomfort was reduced in various body parts. Women farmers were suffering from moderate pain in various body parts like lower back, upper back, knee calf muscle, and fast whereas neck, shoulder, thigh, forearm and palm were suffering from mild pain.

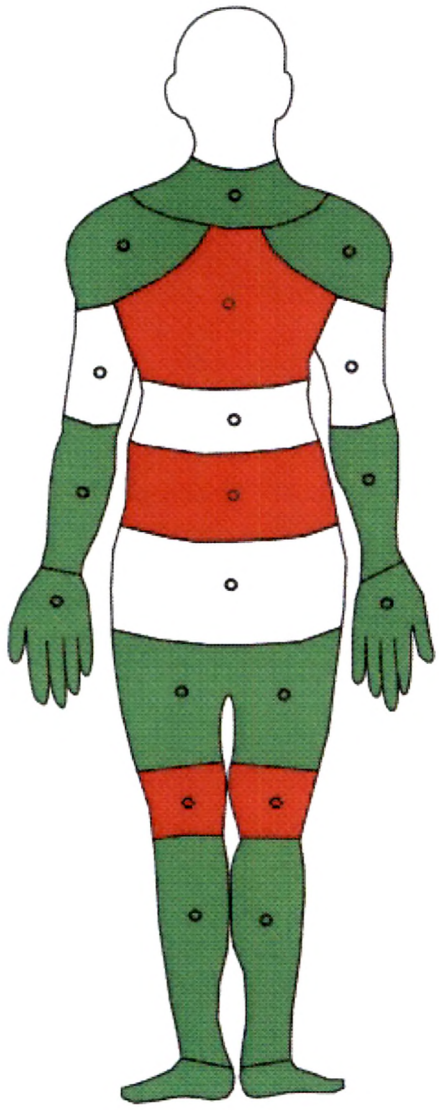


Fig. 4.17 Extent of Body Discomfort Experienced by Women Farmers During Digging of Land with Traditional Technology.

Fig. 4.16 Extent of Body Discomfort Experienced by Women Farmers During Digging of Land with Modified Technology.

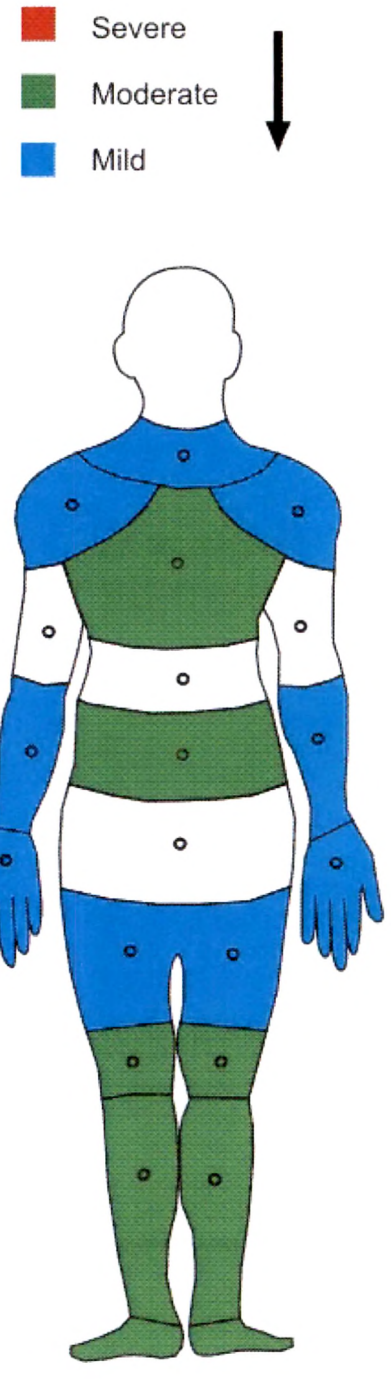


Table: - 4.19 (b) Extent of Body Discomfort During Levelling of Land with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	3 4	-
2.	Lower back	-	-	7.9
3.	Upper back	-	3.8	-
4.	Shoulder	2.1	-	-
5.	Thigh	-	-	7.5
6.	Knee	-	-	8.1
7.	Calf muscle	-	-	6.7
8.	Forearm	-	3.5	-
9.	Palm	-	3.6	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	1 4	-	-
2.	Lower back	1 8	-	-
3.	Upper back	1.5	-	-
4.	Shoulder	1.3	-	-
5.	Thigh	1 3	-	-
6.	Knee	-	4.5	-
7.	Calf muscle	-	4.2	-
8.	Forearm	-	4.0	-
9.	Palm	1.6	-	-
10.	Foot	-	3.4	-

Levelling of land

While levelling of land with the help of traditional technologies women farmers had severe pain in lower back, thigh, knee, and calf muscle whereas neck, upper back, forearm, palm and foot, these body parts were suffering from moderate pain.

The moderate pain was experienced by women farmers in various body parts like knee, calf muscle, fore arm and foot while levelling of land was done with the help of modified technologies. Whereas women farmers wexperienced mild pain in neck, lower back, upper back, shoulder, thigh and palm. (Table 4.19 (b))

Fig. 4.18 Extent of Body Discomfort Experienced by Women Farmers During Levelling of Land with Modified Technology.

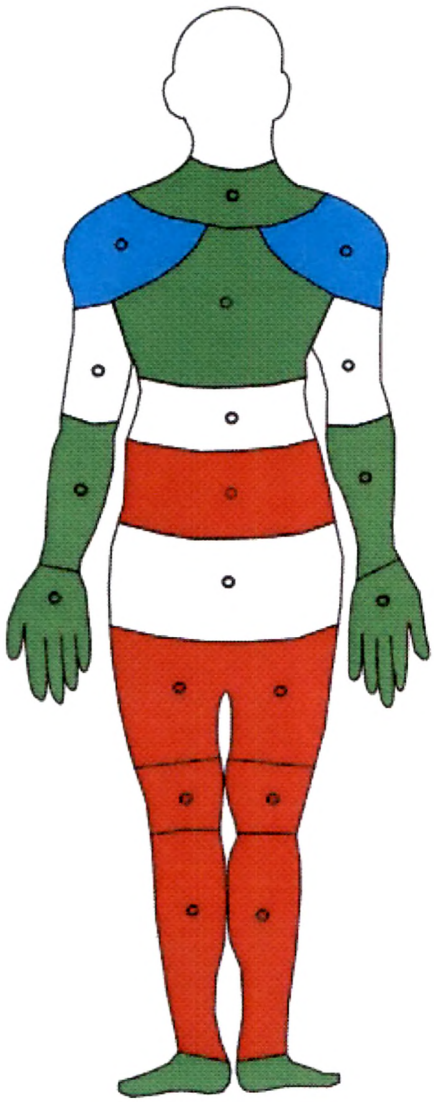


Fig. 4.19 Extent of Body Discomfort Experienced by Women Farmers During Levelling of Land with Traditional Technology.

Table: - 4.19 (c) Extent of Body Discomfort During Application of Manure with Traditional and Modified Technologies.

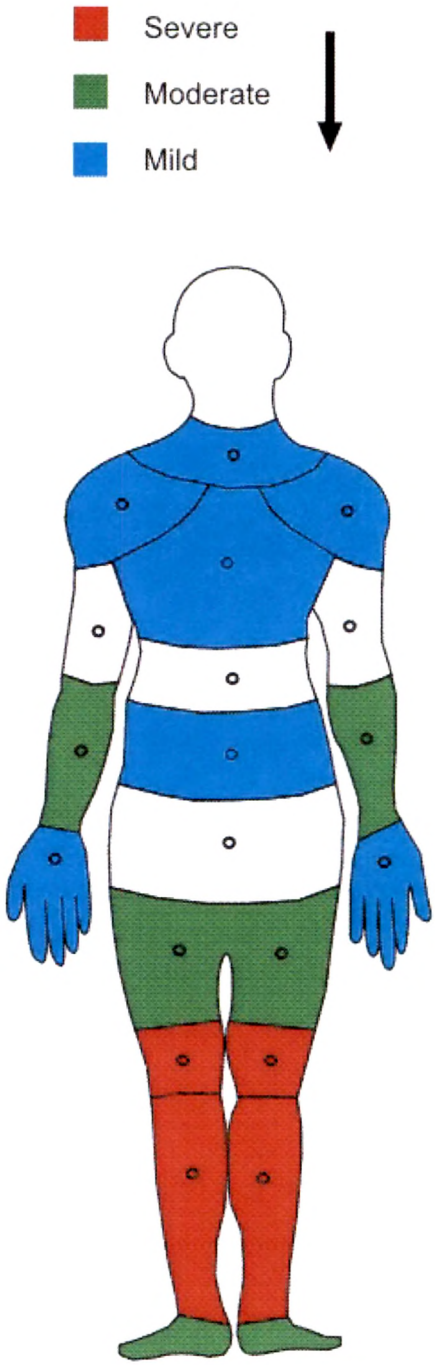
SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	3.4	-
2.	Lower back	-	-	6.8
3.	Upper back	-	4.5	-
4.	Shoulder	-	3.6	-
5.	Thigh	-	3.5	-
6.	Knee	-	-	6.7
7.	Calf muscle	-	-	6.5
8.	Forearm	-	3.5	-
9.	Palm	-	3.6	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	1.2	-	-
2.	Lower back	1.3	-	-
3.	Upper back	1.7	-	-
4.	Shoulder	1.1	-	-
5.	Thigh	-	3.5	-
6.	Knee	-	-	6.7
7.	Calf muscle	-	-	6.7
8.	Forearm	-	3.4	-
9.	Palm	1.1	-	-
10.	Foot	-	3.4	-

Application of manure

It was found that severe pain was experienced by women farmers in various body parts viz, Lower back, knee, and calf muscle while they applied manure in the field by traditional method. Whereas they falt moderate pain in neck, upper back, shoulder, thigh, fore arm, palm and foot.

A severe pain was experienced by women farmers in knee and calf muscle while they applied manure in the field with the help of modified technologies. Whereas they falt mild pain in neck, upper back, lower back, shoulder and palm during this activity. (Table 4.19 (c))

Fig. 4.20 Extent of Body Discomfort Experienced by Women Farmers During Application of Manure with Modified Technology.



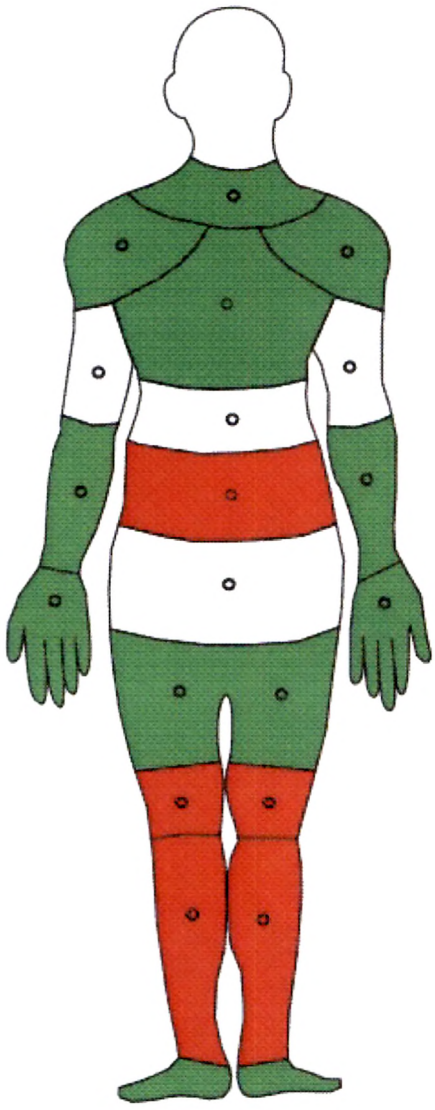


Fig. 4.21 Extent of Body Discomfort Experienced by Women Farmers During Application of Manure with Traditional Technology.

Table: - 4.19 (d) Extent of Body Discomfort During Sowing with Traditional and Modified Technologies.

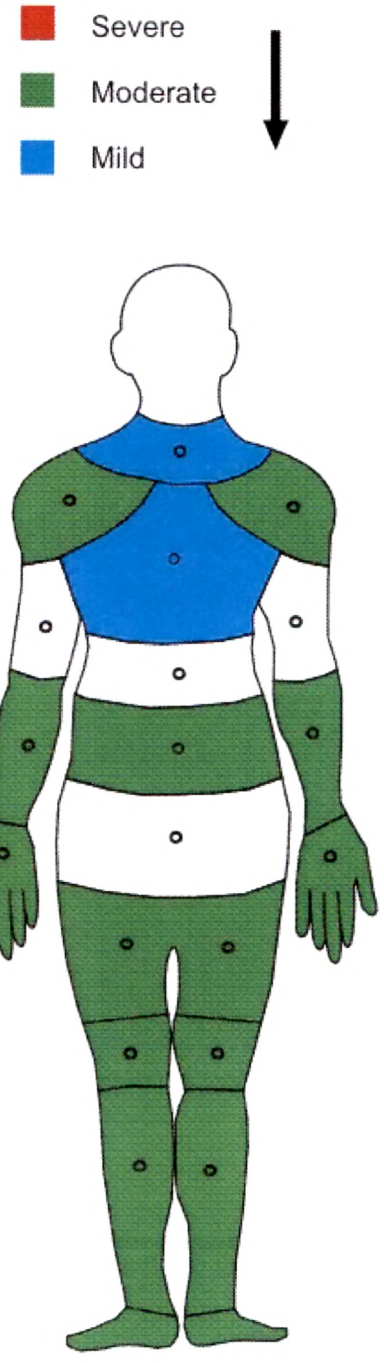
SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	-	8.9
2.	Lower back	-	-	7.3
3.	Upper back	-	-	8.5
4.	Shoulder	-	-	7.0
5.	Thigh	-	-	6.7
6.	Knee	-	-	6.7
7.	Calf muscle	-	-	6.8
8.	Forearm	1.9	-	-
9.	Palm	1.3	-	-
10.	Foot	-	3.5	-
B	**With Modified Technologies**			
1.	Neck	1.5	-	-
2.	Lower back	1.9	-	-
3.	Upper back	-	4.7	-
4.	Shoulder	-	4.0	-
5.	Thigh	-	4.1	-
6.	Knee	-	4.5	-
7.	Calf muscle	-	4.6	-
8.	Forearm	-	4.3	-
9.	Palm	-	4.2	-
10.	Foot	-	3.5	-

Sowing

During sowing women farmers had severe pain in neck, upper back, lower back, shoulder, thigh, knee, calf-muscle while sowing by traditional method.

While sowing was done with the help of modified technology, women farmers were suffering from moderate pain in various body parts like lower back, shoulder, thigh knee, calf muscle, forearm, palm and foot. (Table 4.19(d))

Fig. 4.22 Extent of Body Discomfort Experienced by Women Farmers During Sowing with Modified Technology.



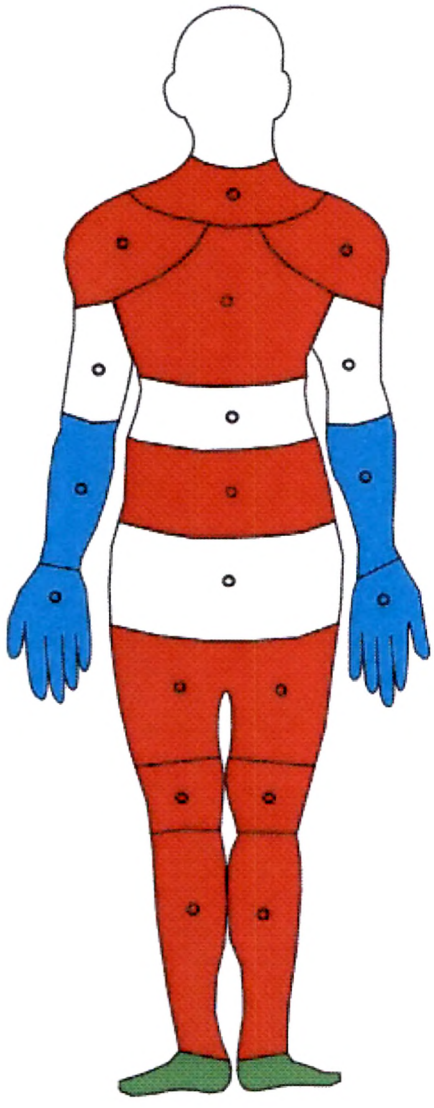


Fig. 4.23 Extent of Body Discomfort Experienced by Women Farmers During Sowing with Traditional Technology.

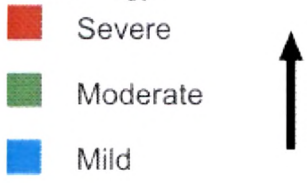


Table: - 4.19 (e) Extent of Body Discomfort During Interculture with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	4.1	-
2.	Lower back	-	-	7.9
3.	Upper back	-	-	8.1
4.	Shoulder	-	5.6	-
5.	Thigh	-	5.2	-
6.	Knee	-	5.7	-
7.	Calf muscle	-	5.3	-
8.	Forearm	-	4.2	-
9.	Palm	-	3.4	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	1.9	-	-
2.	Lower back	-	4.7	-
3.	Upper back	-	5.2	-
4.	Shoulder	-	3.4	-
5.	Thigh	-	3.4	-
6.	Knee	-	4.7	-
7.	Calf muscle	-	4.2	-
8.	Forearm	-	4.1	-
9.	Palm	-	3.4	-
10.	Foot	-	3.5	-

Interculture

When activity of interculture was done with the help of traditional technologies women farmers suffering from severe pain in body parts like upper back and lower back, whereas other body parts like neck, shoulder, thigh, knee, calf muscles, forearm, palm and foot were suffering from moderate pain.

It was examined that when activity of interculture was done with modified technologies women were suffering from moderate pain in various body parts viz, upper back, lower back, shoulder, high, knee, calf-muscle, fore am, palm, and foot (Table: 4.19 (e))

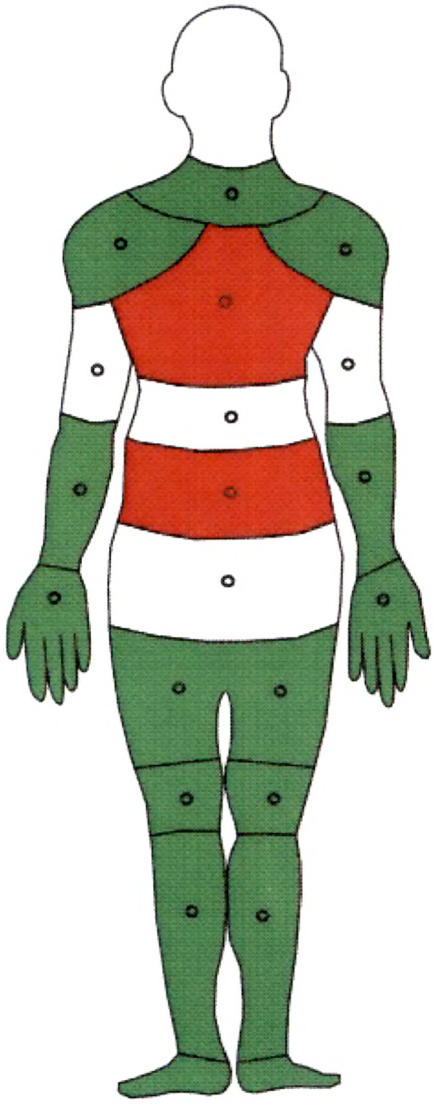


Fig. 4.25 Extent of Body Discomfort Experienced by Women Farmers During Interculture with Traditional Technology.

Fig. 4.24 Extent of Body Discomfort Experienced by Women Farmer During Interculture with Modified Technology.

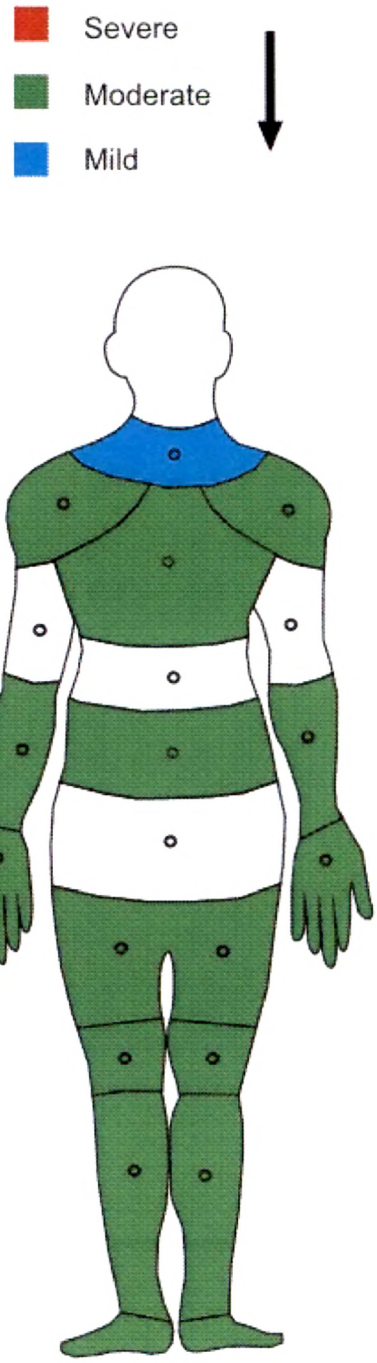


Table: - 4.19 (f) Extenr of Body Discomfort During Hoeing with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	4.2	-
2.	Lower back	-	-	7.7
3.	Upper back	-	-	8.1
4.	Shoulder	-	5.3	-
5.	Thigh	-	5.4	-
6.	Knee	-	5.9	-
7.	Calf muscle	-	5.3	-
8.	Forearm	-	4.0	-
9	Palm	1.9	-	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	-	3.5	-
2.	Lower back	-	4.2	-
3.	Upper back	-	5.1	-
4.	Shoulder	-	3.1	-
5.	Thigh	-	3.3	-
6.	Knee	-	4.9	-
7.	Calf muscle	-	4.2	-
8.	Forearm	-	3.2	-
9.	Palm	1.5	-	-
10.	Foot	-	3.4	-

Hoeing

While hoeing was done with the help of traditional technologies, women farmers were suffering from severe pain in lower and upper back, whereas various body parts viz, neck, shoulder, thigh, knee, calf muscle, forearm, and foot were suffering from moderate pain.

The moderate pain was experienced by women farmers in various body parts viz, neck, upper back and lower back, shoulder, thigh, knee, calf-muscle, forearm and foot. While hoeing was done with the help of modified technologies. (Table 4.19 (f))

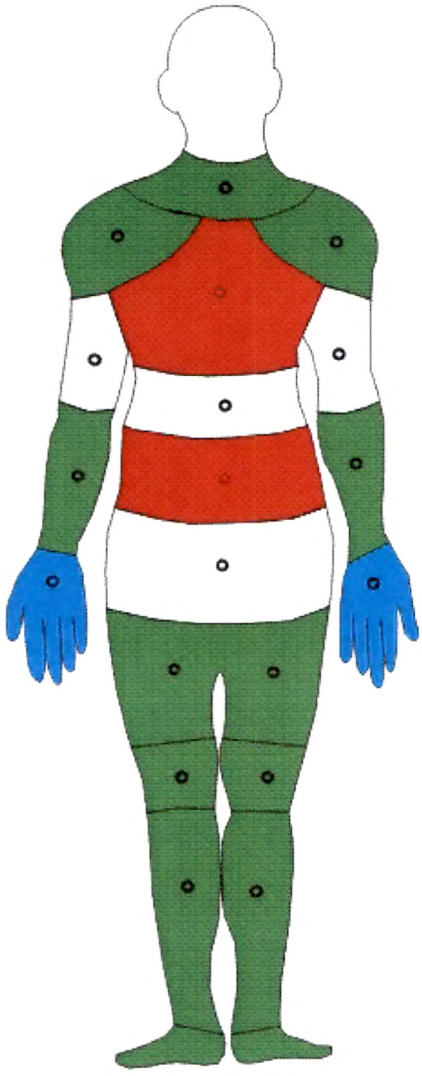


Fig. 4.27 Extent of Body Discomfort Experienced by Women Farmers During Hoeing with Traditional Technology.

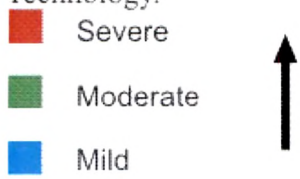
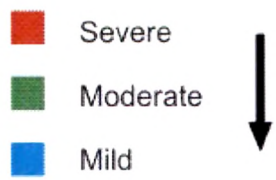


Fig. 4.26 Extent of Body Discomfort Experienced by Women Farmer During Hoeing with Modified Technology.



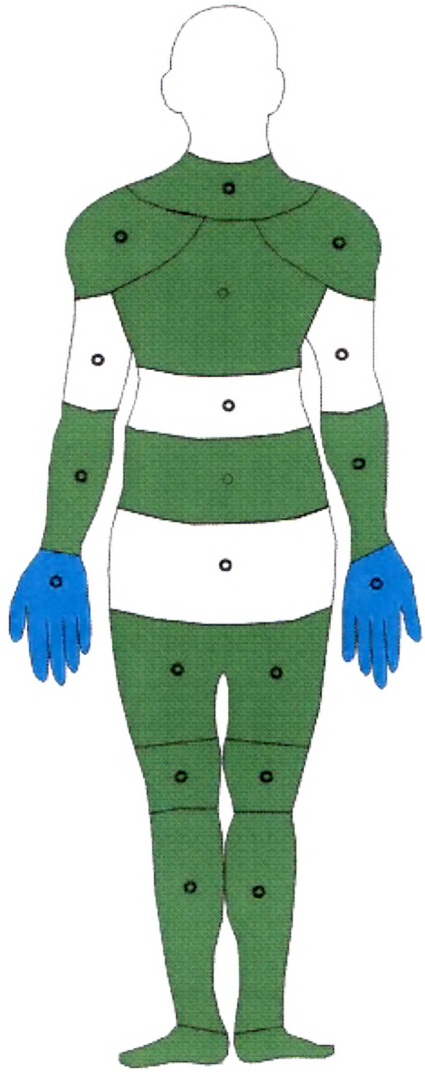


Table: - 4.19 (g) Eztent of Body Discomfort During Weeding with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	4.9	-
2.	Lower back	-	-	7.8
3.	Upper back	-	-	8.3
4.	Shoulder	-	5.9	-
5.	Thigh	-	5.5	-
6.	Knee	-	5.8	-
7.	Calf muscle	-	5.2	-
8.	Forearm	-	4.3	-
9.	Palm	-	5.9	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	-	3.5	-
2.	Lower back	-	5.3	-
3.	Upper back	-	5.8	-
4.	Shoulder	-	4.3	-
5.	Thigh	-	4.2	-
6.	Knee	-	5.1	-
7.	Calf muscle	-	4.7	-
8.	Forearm	-	3.4	-
9.	Palm	-	4.8	-
10.	Foot	-	8.1	-

Weeding

It was note that when weeding was done with the help of traditional technology, women farmers were suffering from body discomfort in various body parts viz, hook , shoulder, thigh, knee, calf-muscle, forearm, palm, foot except upper back and lower back. These were suffering from sever pain.

Weeding was done with the help of modified technologies, women farmers had moderate pain in above body parts. (Table 4.19 (g)).

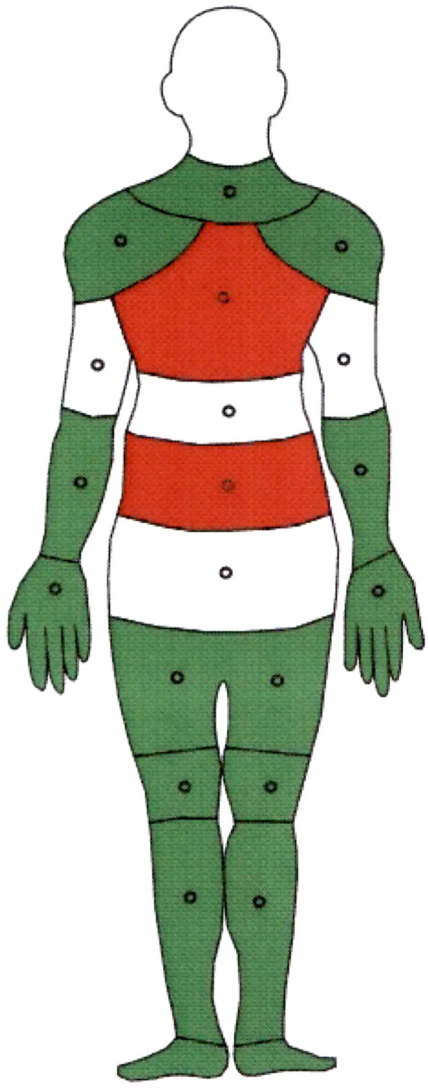


Fig. 4.29 Extent of Body Discomfort Experienced by Women Farmers During Weeding with Traditional Technology.

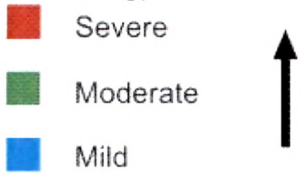


Fig. 4.28 Extent of Body Discomfort Experienced by Women Farmer During Weeding with Modified Technology.

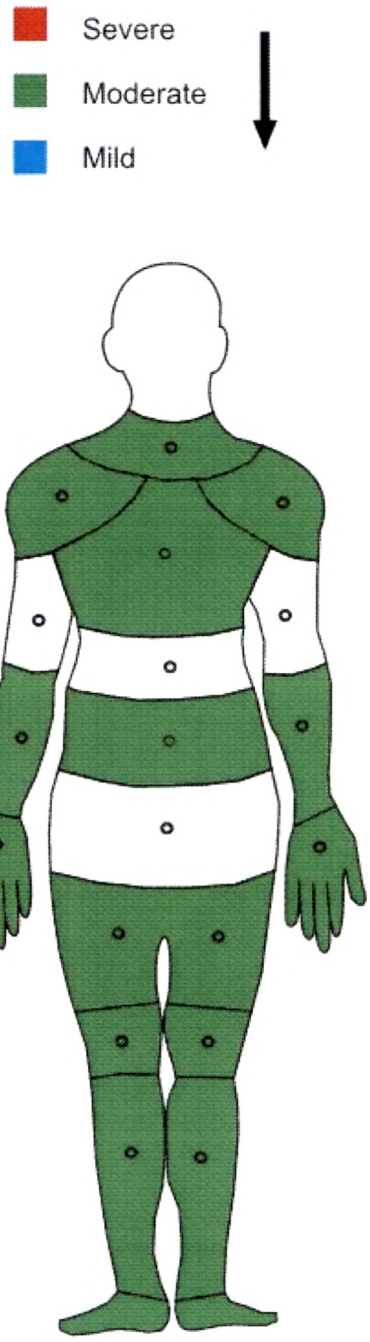


Table: - 4.19 (h) Extent of Body Discomfort During Harvesting with Traditional and Modified Technologies.

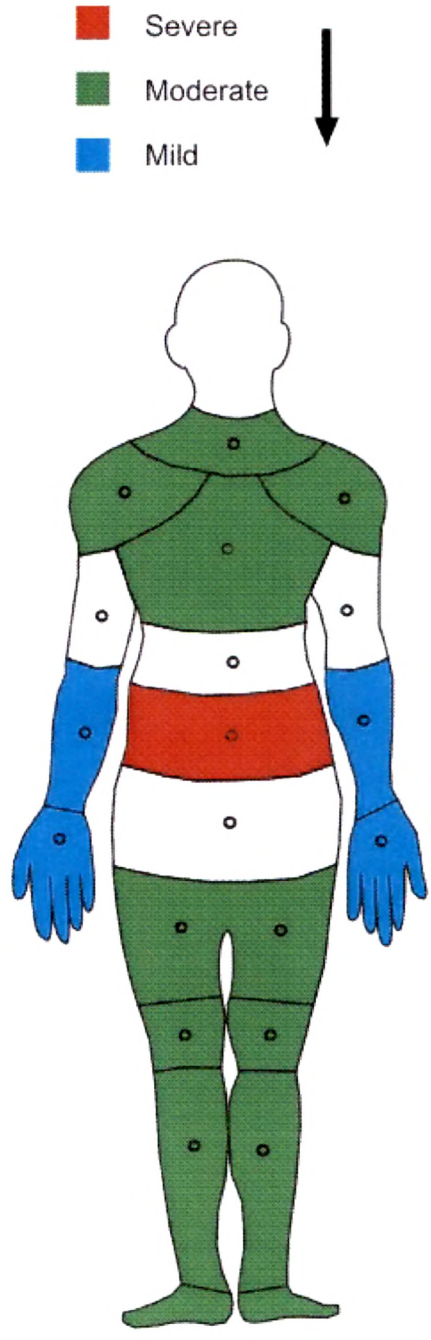
SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	4.3	-
2.	Lower back	-	5.9	-
3.	Upper back	-	-	7.8
4.	Shoulder	-	4.2	-
5.	Thigh	-	5.9	-
6.	Knee	-	5.7	-
7.	Calf muscle	-	5.1	-
8.	Forearm	-	3.4	-
9.	Palm	-	3.4	-
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	-	4.3	-
2.	Lower back	-	5.9	-
3.	Upper back	-	-	7.8
4.	Shoulder	-	4.2	-
5.	Thigh	-	5.7	-
6.	Knee	-	5.5	-
7.	Calf muscle	-	5.1	-
8.	Forearm	2.5	-	-
9.	Palm	1.9	-	-
10.	Foot	-	3.4	-

Harvesting

The moderate pain in neck, upper back, shoulder, thigh, knee, calf muscle, forearm, palm and foot during harvesting with the help of traditional sickle while they had sever pain in lower back during this activity.

When harvesting was done with the help of modified technology. Women farmers had mild pain in forearm and palm as compared to traditional technologies. (Table 4.19 (h)).

Fig. 4.30 Extent of Body Discomfort Experienced by Women Farmer During Harvesting with Modified Technology.



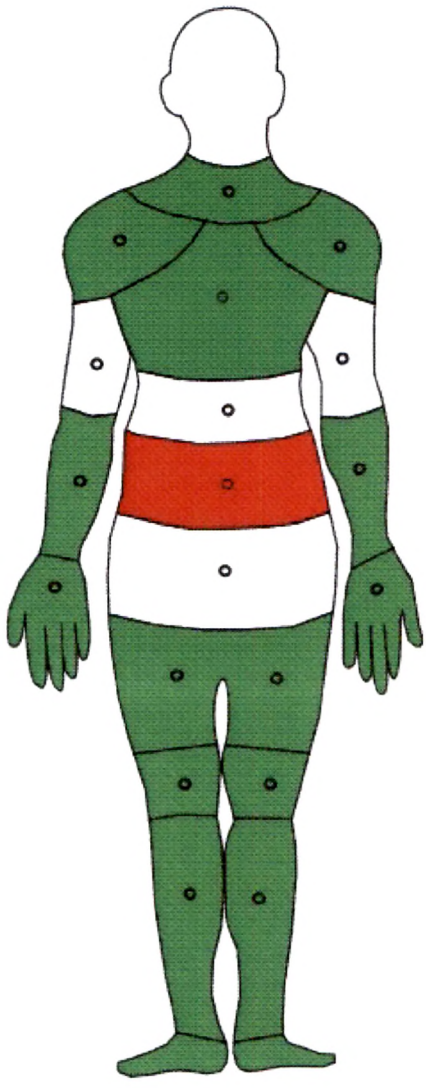


Fig. 4.31 Extent of Body Discomfort Experienced by Women Farmers During Harvesting with Traditional Technology.

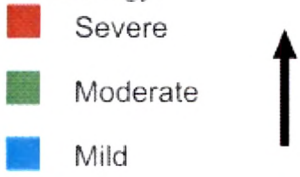


Table: - 4.19 (i) Extent of Body Discomfort During Threshing with Traditional and Modified Technologies.

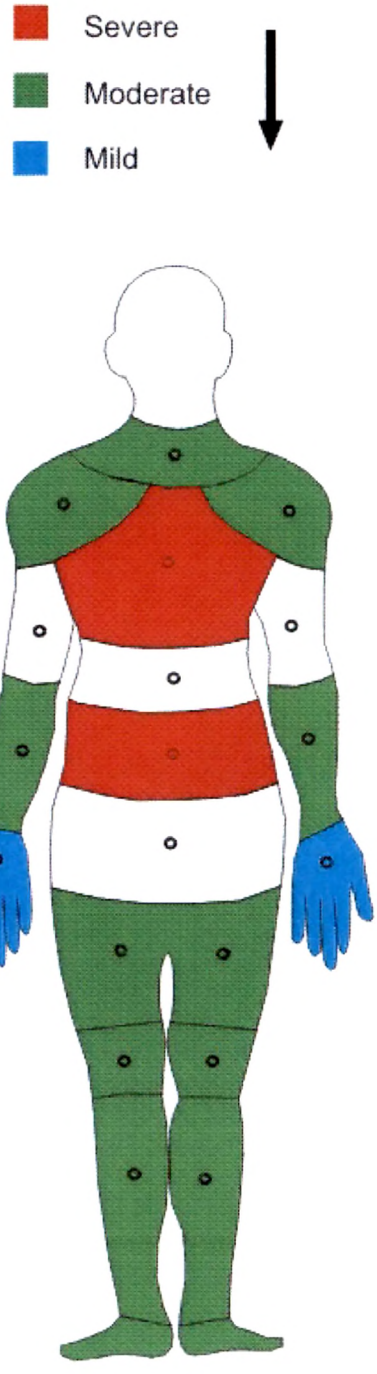
SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	5.2	-
2.	Lower back	-	-	7.5
3.	Upper back	-	-	7.9
4.	Shoulder	-	5.5	-
5.	Thigh	-	5.6	-
6.	Knee	-	5.9	-
7.	Calf muscle	-	5.2	-
8.	Forearm	-	4.2	-
9.	Palm	-	-	8.9
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	-	5.1	-
2.	Lower back	-	-	7.5
3.	Upper back	-	-	7.9
4.	Shoulder	-	5.5	-
5.	Thigh	-	5.6	-
6.	Knee	-	5.9	-
7.	Calf muscle	-	5.1	-
8.	Forearm	-	4.1	-
9.	Palm	1.9	-	-
10.	Foot	-	3.4	-

Threshing

While activity of threshing was done with the help of traditional method women farmers had sever pain in upper back, lower back, and palm.

Whereas above activity was done with the help of modified method women farmers had mild pain in palm during this activity was compared to traditional technologies. (Table 4.19 (i)).

Fig. 4.32 Extent of Body Discomfort Experienced by Women Farmer During Threshing with Modified Technology.



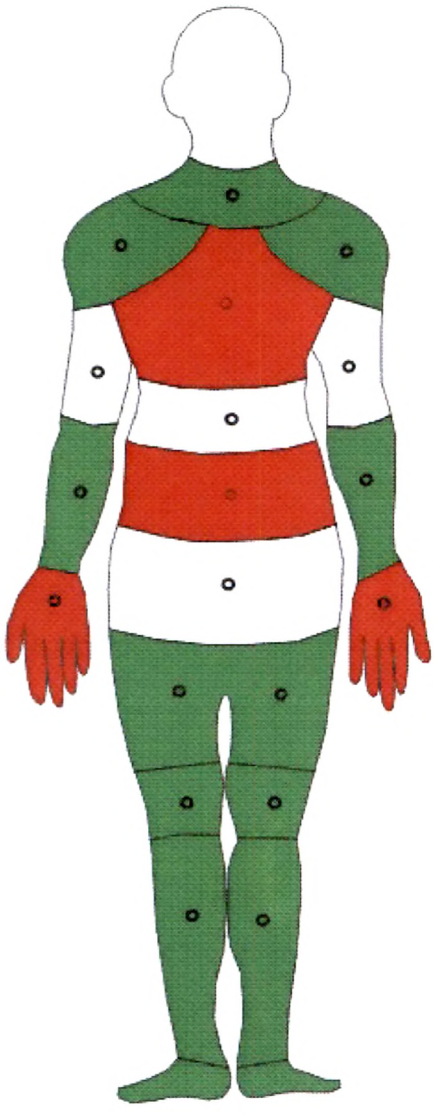


Fig. 4.33 Extent of Body Discomfort Experienced by Women Farmers During Threshing with Traditional Technology.

Table: - 4.19 (j) Extent of Body Discomfort During Winnowing with Traditional and Modified Technologies.

SR. No.	Body Regions	Mean body discomfort score (n=6)		
		Mild (1 – 3.3)	Moderate (3.4 – 6.6)	Severe (6.7 – 10)
A	**With Traditional Technologies.**			
1.	Neck	-	5.1	-
2.	Lower back	-	-	7.6
3.	Upper back	-	-	7.9
4.	Shoulder	-	5.1	-
5.	Thigh	-	5.6	-
6.	Knee	-	5.8	-
7.	Calf muscle	-	5.2	-
8.	Forearm	-	4.2	-
9.	Palm	-	3.8	
10.	Foot	-	3.4	-
B	**With Modified Technologies**			
1.	Neck	-	5.0	-
2.	Lower back	-	5.6	-
3.	Upper back	-	5.7	-
4.	Shoulder	-	4.5	-
5.	Thigh	-	5.5	-
6.	Knee	-	4.9	-
7.	Calf muscle	-	4.5	-
8.	Forearm	-	4.2	-
9.	Palm	-	3.4	-
10.	Foot	-	3.4	-

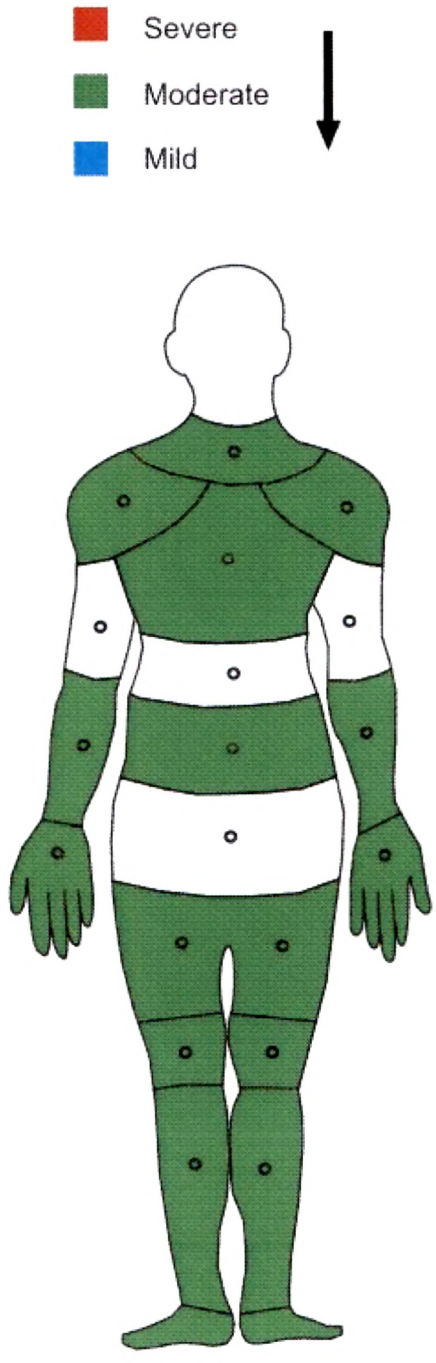
Winnowing

In was observed that when activity of winnowing was done with the help of traditional method, women farmers had sever pain in upper back, lower back and palm.

The moderate pain was experienced by women farmers in various body parts viz. Neck, upper back, lower back, shoulder, thigh, knee, calf-muscle, forearm, palm and foot during winnowing with the help of modified technologies (Table 4.19 (j))

Thus on the whole the level of discomfort decreased considerably when the women farmers used modified technologies.

Fig. 4.34 Extent of Body Discomfort Experienced by Women Farmer During Winnowing with Modified Technology.



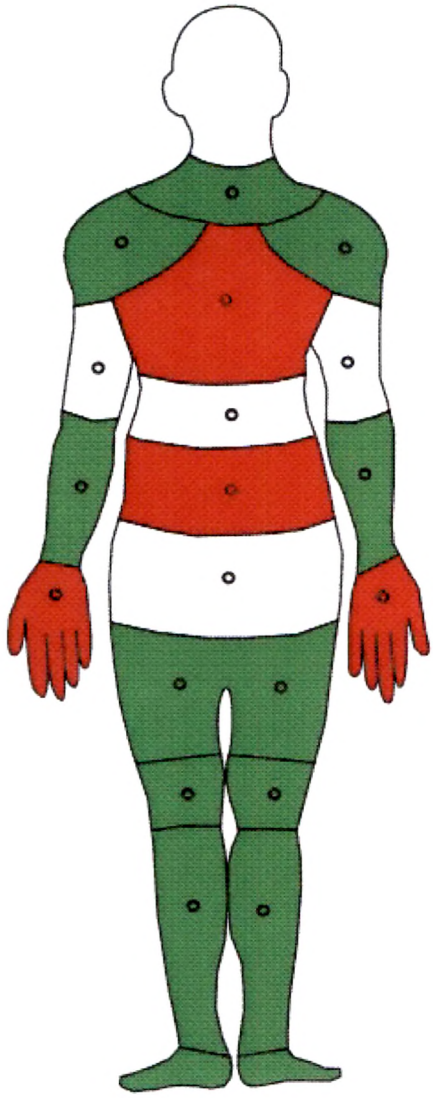


Fig. 4.35 Extent of Body Discomfort Experienced by Women Farmers During Winnowing with Traditional Technology.

Attitude of Women Farmers Towards Acceptance of Modified Technologies

Women were perhaps the first to domesticate the crop plants, and have played a pivotal role in the development of agriculture. All the rural women of Uttranchal are engaged in organic farming. Improved hand tools and implements have good scope and potential for hill mechanization because women farmer are still using traditional implements. The hill women are involved in most of the agricultural and household activities, and working under physical stress. They are interested in using improved tools and implements

Human behavior is largely a function of attitude and more so in a free choice society. Sherif and Cantrill (1945) pointed out that predisposition to action is an essential feature of an acceptable definition of attitude. Thurstone (1929) defined attitude as the degree of positive or negative affect associated with some psychological object.

An attitude scale was prepared for finding out attitude of women farmers acceptance of new technology.

The responses were recorded on three points continuum i.e. 'agree', 'undecided' and 'disagree' with respective weightage of 3, 2, 1 for positive statements and 1, 2, 3 for negative statement.

Distribution of Women Farmers in Relation to their Scores on Attitude Scale

Data from table 4.20 showed that more than half of the women farmers i.e. 66.66 percent possessed favorable attitude towards acceptance of modified technologies in organic farming and about 16.66 percent of them had neutral attitude and same percentage i.e. 16.66 percent had unfavorable attitude acceptance of modified technologies.

Table: 4.20 Distribution of Women Farmers in Relation to their Scores on Attitude Scale

SR. No.	Level of Attitude and Score Ranges	Total (N = 6)
1.	Unfavorable Attitude (22 – 30)	1 (16.66)
2.	Neutral Attitude (31 - 39)	1 (16.66)
3.	Favorable Attitude (40 - 66.0)	4.00 (66.66)

Figures in parentheses indicated percentage.

Ergonomic Assessment of Modified and Traditional Technologies/Tools:

Hand tools are used in all kinds of production processes, not only in the industrial production but also in the agriculture and household. The forces necessary arise from the human muscle strength. Thus, hand tools are normally not used in long-term processes but they are needed for works which go beyond the human capacity.

Within the ergonomic equipment design, the designing of hand tools plays an important role, because both the efficiency and the working process itself act as the interface between user, and his task.

In the ergonomic design process not only technical and formal- asthetic aspect are of importance but also anthropometrical, biomechanical, physiological criteria and aspect concerning occupational are equally important.

To realise the efficient, comfortable and safe human use of hand tools the design parameters are oriented to the characteristics and abilities of a specific user group (e.g. height, physical strength, freedom of movement, sensory perception and information processing).

Working with hand tools can involve enormous risks of accidents, especially when they are not used at workstations with constant working conditions but in varying applications. Both the hand tool and the object the user is working on can cause accidents. When a had tool is designed, aspects of safety should be considered to protect the worker effectively from stain and risks (Hecker 1997.)

The use of hand tools can cause great strain on the had because of impulsive work process. Measures that reduce shock and vibration should already be taken when designing a hand tool.

Procedure for assessment of modified tools was based on checklist provided by Central Institute of Agriculture Engineering (CIAE), Bhopal. Physiological cost of work in terms of heart rate (beats/min) anthropometry, posture and grip strength were the parameter taken into consideration.

Table 4.21 : Various Parameters of Physiological Cost of Work Used for Assessment of Modified Technologies.

Sr. No.	Tools	Heart rate (beats/min)	EE (kJ/min)	T.C.C.W. (beats)	Postural Stress		Grip Strength (kg)	
					Upper	Lower	Right	Left
A.	**Modified Technologies**							
1.	Hoe	125.52	12.6880	957.66	214.1	199.93	15.05	12.98
			± 0.860	± 24.67	± 3.85	± 3.37	± 0.38	± 0.44
2.	Kutla	120.90	10.728	741.00	212.71	207.06	14.29	14.83
			± 0.236	± 22.16	± 4.36	± 1.25	± 0.64	± 0.46
3.	Land leveler	117.16	11.564	617.00	216.25	204.33	14.52	13.43
			± 0.339	± 18.50	± 2.77	± 2.48	± 0.23	± 0.65
4.	Hand Scraper	119.13	10.757	636.16	213.21	200.03	17.10	13.58
			± 0.511	± 11.03	± 0.75	± 0.17	± 0.76	± 0.485

Table 4.21 Cont...

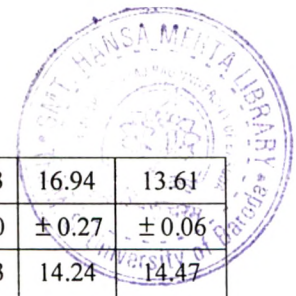


Table 4.21 Cont...

5.	Maize Seeder	130.02	10.015	695.66	212.9	199.93	16.94	13.61
			± 1.164	± 61.34	± 6.15	± 1.80	± 0.27	± 0.06
6.	Tubular Maize Sheller	105.10	8.787	519.00	216.05	202.93	14.24	14.47
			± 0.335	19.33	± 1.65	± 0.25	± 11.1	± 1.11
7.	Sickle	116.50	9.865	705.0	216.26	203.66	14.85	12.69
			± 0.335	+77.5	± 0.32	± 0.30	± 0.85	± 0.665
B.	**Traditional Technologies**							
1.	Kudal	130.70	12.463	763.16	216.46	203.31	13.65	12.85
			± 0.236	± 22.16	± 4.36	± 1.25	± 0.64	± 0.46
2.	Hoe	139.00	13.248	982.33	217.95	203.3	14.67	12.54
			± 0.560	± 24.67	± 3.85	± 3.37	± 0.38	± 0.44
3.	Sickle	121.69	10.200	722.5	216.58	203.36	13.99	12.025
			± 0.335	± 17.5	± 0.32	± 0.32	± 0.86	± 0.665

Ergonomic Assessment of Traditional Technologies

Traditional Hoe

It was used for digging of land and hoeing, and made up of wood and Iron. Length of the handle was 60.0 cm. Diameter of handle (width) was 5.3 cm. Blade was in rectangular in structure. Length and width of blade was 20.5 cm and 17.5 cm respectively. There was no wheel.

Mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0 ±0.03 cm (8.8 cm and 12.5 cm) 7.5 ±0.12cm (6.0 cm and 8.9 cm) and 3.5±0.07 cm (3.0 cm and 4.0 cm), respectively, mean height of elbow as 102.8 ± 4.38 cm with 5^{th} and 95^{th} percentile i.e. 97.3 cm and 107.9 cm, respectively. (Table.4.10) It was found that length of handle was less as compared to mean elbow height of women farmers.

Table 4.22 Ergonomic Assessment of Traditional Hoe

Sr. No.	Implements/Equipment	Remark
1.	Name of the implement	Traditional hoe
2.	Operation for which used	Digging of land and hoeing
3.	Details of handles	
(i)	Length	60.0 cm
(ii)	Width	-
(iii)	Height	-
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	5.3 cm
4.	Details of Blade	
(i)	Size and Shape	20.5 cm length, 17.5 cm width, rectangular shape.
(ii)	Material	Iron
(iii)	Protection and safety	-
5.	Details of wheel	Not required
6.	Tools as a whole	-
(i)	Dimensions	-
(ii)	Shape and constructions	Constructed in length wise
(iii)	Material	Iron and wood
(iv)	Maintenance	-
7.	Protection and safety	-
	Subjects Feed Back	
(i)	Whether the equipment is suitable to the body dimension of the operator	No
(ii)	Does the required operation of the equipment is with in the acceptable limits of the operator?	No
(iii)	Does the operator face any problems during operation?	Experienced pain various body part during operation.
(iv)	Overall comments of the subjects about equipment and/or operation.	No comments

Fig 4.36 Digging of Land with Traditional Hoe

The physiological cost in terms of heart rate, energy expenditure, T.C.C.W. muscular stress and postural stress were more as compared to modified hoe. Body discomfort was also more and output was less with traditional hoe.

It was found that required operation of the equipment/tool was not in the acceptable limits of the operator. Women farmers felt body pain during performing the activities because improper and faulty designing of tools like short handle and diameter of handle was slightly more.

There was need to some modification in traditional hoe on the basis of the basic of ergonomic parameters.

Kudal

It was used for digging of land, sowing, interculture, weeding and hoeing. It was made up of Iron and wood. Length of the handle was 35.0 cm and diameter was 5.00 cm. Blade was made up of Iron, Sharp, and pointed. Length of blade was 13.5 cm. There was no wheel.

Mean fist length, mean had grip length and grip inside diameter with 5^{th} and 95^{th} were 10.0 ±0.31 cm (8.8 cm and 12.5 cm) 7.5± 0.12 cm (6.0 cm and 8.9 cm) and 3.5±0.07 cm (3.0 cm and 4.0 cm), respectively, mean height of elbow as 102.8 ± 4.38 cm with 5^{th} and 95^{th} percentile i.e. 97.3 cm and 107.9 cm, respectively. (Table, 4.10 It was found that length of handle was very short as compared to mean elbow height of women farmers.

It was found that required operation of the equipment/tool was not in the acceptance limits of the operator. Women farmers experienced body pain in various part of the body because of improper designing of tool like short handle and diameter of handle was slightly more. There was need to some modification in kudal on the basis of ergonomic parameters.

Table 4.23 Ergonomic Assessment of Traditional (Kudal)

Sr. No.	Implements/Equipment	Remark
1.	Name of the implement	Kudal
2.	Operation for which used	Digging of land and sowing, interculture hoeing, weeding.
3.	Details of handles	
(i)	Length	35.0 cm
(ii)	Width	-
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	5.00 cm
4.	Details of Blade	
(i)	Size and Shape	Length of blade – 13.5 cm, sharp and pointed
(ii)	Material	Iron
(iii)	Protection and safety	-
5.	Details of wheel	-
6.	Tools as a whole	-
(i)	Dimensions	-
(ii)	Shape and constructions	Constructed in length wise
(iii)	Material	Iron and wood
(iv)	Maintenance	-
7.	Protection and safety	-
	Subjects Feed Back	
(i)	Whether the equipment is suitable to the body dimension of the operator	No
(ii)	Does the required operation of the equipment is with in the acceptable limits of the operator?	No
(iii)	Does the operator face any problems during operation?	Sever lower back pain during operation.
(iv)	Overall comments of the subjects about equipment and/or operation.	No comments

Fig 4.37 Interculture with (Kudal) Traditional Technology

Fig 4.38 Hoeing with (Kudal) Traditional Technology

Traditional Sickle

This was made up of wood and Iron. It was used for harvesting of crops. Length of handle was 19.0 cm and made up of wood, there were no adjustment functions in handle and blade. Diameter of handle was 4.5 cm. Blade was made up of iron which was sharp and plain.

Mean fist length, mean had grip length and grip inside diameter with 5^{th} and 95^{th} were 10.0±0.3 cm (8.8 cm and 12.5 cm) 7.5±0.12 cm (6.0 cm and 8.9 cm) and 3.5±0.07 cm (3.0 cm and 4.0 cm), respectively, mean height of elbow as 102.8 ± 4.38 cm with 5^{th} and 95^{th} percentile i.e. 97.3 cm and 107.9 cm, respectively.

It was found that diameter of handle was slightly more as compared to mean grip inside diameter of women farmers and blade could be changed from plain to serrated sickle.

There were slight variations in physiological cost of work in terms of heart rate, energy expenditure, ICCW and postural Stress. But there were significant difference in muscular stress and body discomfort.

It was found that required operation of the equipment/tool was not in the acceptance limits of the operator. Women farmers experienced palm pain during activity, due to improper designing of handle and blade.

There was need to some modification in sickle the light of ergonomic parameters.

Table 4.24 Ergonomic Assessment of Traditional Technology (Traditional Sickle)

Sr. No.	Implements/Equipment	Remark
1.	Name of the implement	Traditional Sickle
2.	Operation for which used	For harvesting
3.	Details of handles	
(i)	Length	19.0 cm
(ii)	Width	-
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	4.5 cm
4.	Details of Blade	
(i)	Size and Shape	Sharp and plain
(ii)	Material	Iron
(iii)	Protection and safety	-
5.	Details of wheel	Not required
6.	Tools as a whole	-
(i)	Dimensions	-
(ii)	Length	45.0 cm
(iii)	Shape and constructions	Sharp and well constructed
(iv)	Material	Iron and wood
(v)	Maintenance	-
7.	Protection and safety	-
	Subjects Feed Back	
(i)	Whether the equipment is suitable to the body dimension of the operator	No
(ii)	Does the required operation of the equipment is with in the acceptable limits of the operator?	No
(iii)	Does the operator face any problems during operation?	No
(iv)	Overall comments of the subjects about equipment and/or operation.	No

Modified Hoe

This was made up of wood and iron. It was used for digging of land, hoeing and weeding. Length of handle was 103.75 cm. Handle was made up of wood. There was no adjustment function in blade. Blade was made up of Iron. (Sharp and pointed) and length of blade was 11.75 cm. There was o wheel in tools. The physiological cost in terms of heart rate was less as compared to traditional technologiesi.e. 'Kudal'. Energy expenditure and TCCW were also less as compared to kudal. It was observed that although the subjects were in a better body posture as compared to kudal, angle of deviation was less in upper and lower portion of back. It was also found that grip strength was also less in right and left hand. Tool was suited to the body dimensions of the operator/women farmer. Mean height of elbow was 107.4 cm ± 4.38 with 5^{th} and 95^{th} percentiles i.e. 97.3 cm and 102.8 cm respectively. Mean had grip length, mean fist length, grip inside diameter with 5^{th} and 95^{th} percentile were 10.0 ±0.31 cm, (8.8cm and 12.5 cm), 7.5± 0.12cm (6.0 and 8.9 cm) and 3.5 ±0.07cm (3.10 and 4.2 cm) respectively.(table 4.10) There is a direct interrelation between digging of land, hoeing, weeding, form of movement, manner of gripping and blade type. It was found that required operation of the equipment was with in the acceptable limits of the operator and no problems were faced during operations.

However, while performing activities digging of land, hoeing and weeding to reduce physiological cost of work (heart rate), energy expenditure muscular stress, postural stress and body discomfort, It was to be noted that women farmers was using kudal since childhood whereas they had practice with improved/modified hoe for few days only. It is therefore, felt that with sufficient practice for more output, (Table : 4.21 & 4.22). There is a neeed of minor modification in handle of hoe for better griping .

Table no. 4.25 Ergonomic Assessment of Modified Hoe

Sr. No.	Implements/Equipments	Remark
1.	Name of the Implement	Hoe
2.	Operation for which used	Digging of land, hoeing, weeding.
3.	Details of handle	
(i)	Length	103.75cm
(ii)	Width	4.25 cm
(iii)	Height	103.75 cm
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	4.25 cm
4.	Details of Blade	
(i)	Size and Shape	11.25 cm– length, sharp and pointed
(ii)	Material	Iron
(iii)	Maintenance	Sharpening time to time
(iv)	Protection and safety	Looseness in between handle and blade.
5.	Details of Wheel	Not required
6.	Tools as a whole	
(i)	Dimensions	-
(ii)	Shape and construction	This was made up of wood and Iron, well constructed, sharp and pointed, constructed in lengthwise.
(iii)	Material	Wood and Iron
(iv)	Maintenance	Sharp the blade time to time and light the blade with handle.
(v)	Protection and Safety	-
7.	Subject Feedback	
(i)	Whether the equipment is suitable to the body dimensions of the operator.	Yes
(ii)	Does the required operation of the equipment is within the acceptable limits of the operator?	Yes
(iii)	Does the operator face any problem during operations?	No
(iv)	Overall comments of the subjects about equipment and/or operation.	No comment

Fig 4.39 Hoeing with Modified Hoe

Fig 4.40 Weeding with Traditional Method

Fig 4.41 Weeding with (Hoe) Modified Technology

Kutla

This was made up of wood and iron. It was used for hoeing and weeding. Length of handle was 85.5 cm. Handle was made up of wood. Diameter of handle was 4.25 cm. There was no adjustment function in handle and blade. Blade was made up of Iron. Length of blade was 11.75 cm. There was no wheel in tool.

The physiological cost in term of heart Energy expenditure, T.C.C. W. postural stress, muscular stress rate was less as compared to traditional technology i.e. kudal. Output was more as compared to kudal. It was observed that although the subjects were in a better body posture, angle of deviation was less in upper and lower back. Tool was suited to the body dimensions of the women farmers. Mean height of elbow was 107.8 cm ± 4.38 with 5^{th} and 95^{th} percentile i.e. 97.3cm and 107.4cm respectively. Mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0 ±0.31cm. (8.8cm & 12.50cm), 7.5±0.12cm (6.0 cm & 8.9 cm) and 3.5±0.07 cm (3.0 cm and 4.0cm) respectively.(Table 4.10) There was a direct interrelation between weeding and hoeing, form of movement, manner of gripping and blade type. It was found that required operation of the equipment/tool is with in the acceptable limits of the operation on the basis of subject feed back and problem faced by women was that the became loose during operation (Table 4.21 & 4.23)

Handle

There was enough space to admit all four fingers and thumb. Shape of handle was appropriate, for power grip, design for maximum surface contact. So as to minimize unit pressure of the hand. Handle was made up of wood. Wood was readily available, easily worked, good resistance to shock and good frictional quality.

Table no. 4.26 Ergonomic Assessment of Modified Kutla

Sr. No.	Implements/Equipments	Remark
1.	Name of the implements	Kutla
2.	Operation for which used	Weeding and hoeing
3.	Details of handle	
(i)	Length	82.5 cm
(ii)	Width	4.25 cm
(iii)	Height	-
(iv)	Material	Iron
(v)	Diameter	4.2 cm
(vi)	Details of adjustment	No adjustment
4.	Details of Blade	
(i)	Size and shape	Length 11.25 cm. sharp and pointed.
(ii)	Material	Iron
(iii)	Maintenance	-
(iv)	Protection and Safety	-
5.	Details of wheels	Not rquired
6.	Tool as a whole	
(i)	Dimensions	
(ii)	Shape and construction	This is made up of wood and Iron, well-constructed, sharp and pointed construction in lengthwise.
(iii)	Materials	Wood and Iron
(iv)	Maintenance	
(v)	Protection and safety	
7	Subject Feedback	
(i)	Whether the equipment was suitable to the body dimensions of the operator?	Yes
(ii)	Does the required operations of the equipment is with in the acceptance limits of the operator.	Yes
(iii)	Does the operator face any problems during operation.	Yes
(iv)	Is there any breakdown, repair and maintenance problem during work.	Yes

Fig 4.42 Interculture with (Kutla) Modified Technology

Angulations of tool handles may be necessary to maintain a straight wrist. The handle should reflect the axis of grasp. It was appropriate in kulta.

When hoeing and weeding was done with the help of kutla, physiological cost of work in terms of heart rate, energy expenditure, muscular stress, postural stress and body discomfort were less as compared to kudal.

It is to be noted women farmers were using kudal since childhood whereas they had practice with modified kulta for few days only. It is therefore, felt that with sufficient practice more output could be obtained. There is a need of minor modification in handle of kulta for proper gripping.

Land Leveller:

It was for levelling of land. It was made up of only wood. Length of the handle was 130.0 cm. diameter of handle was 4.25 cm. There was no adjustment function in handle and blade of land leveller. Length of the blade was 18.75 cm and it was semi-circular shape. There was no wheel.

Tool was suited almost to the body dimensions mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0 cm (8.8 cm and 11.5 cm), 7.5cm (6.0 cm and 8.9 cm) and 3.5 cm (3.0 cm and 4.0 cm) respectively. Mean elbow height was 107.8=4.38 with 5^{th} and 95 th percentile i.e. 97.3cm and 110cm It was found that length of handle was slightly more as compared to mean elbow height of women farmers.

The physiological cost in terms of heart rate was less as compared to traditional technology (manually). Energy expenditure, TCCW postural stress, muscular stress and body discomfort were more. Output was more as compared to levelling of land was done by manually. It was observed that although the subjects were in a better body posture standing cum bending posture, angle of deviation was less in upper and in lower back.

Table No. 4.27 Ergonomic Assessment of Modified Land leveler

Sr. No.	Implements/Tool	Remark
1.	Name of the implements/tool	Land leveller
2.	Operation for which used	Land levelling
3.	Details of handle	
(i)	Length	130.0 cm
(ii)	Width	4.25 cm
(iii)	Height	-
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	4.25 cm
4.	Details of blade	
(i)	Size and shape	Length – 11.25 semi-circular shape.
(ii)	Material	Wood
(iii)	Maintenance	-
(iv)	Protection and safety	-
5.	Details of wheel	Not required
6.	Tool as a whole	
(i)	Dimensions	
(ii)	Shape and Construction	Well-constructed blunt, semi-circular shape, constructed in lengthwise wood.
(iii)	Material	Wood
(iv)	Maintenance	
(v)	Protection and safety	
B	Subject Feedback	
1.	Whether the equipment is suitable to the body dimension of the operator.	Yes
2.	Does the required operation of the equipment is within the acceptance limits of the operator.	Yes
3.	Does the operator face any problems during operations.	Yes
4.	Is there any breakdown, repair and maintenance problem during work?	No
5.	Overall comments of the subjects about implement/tool.	Slightly modification in length of handle and grip.

Fig 4.43 Levelling of land with land leveller

There was a direct interrelation between levelling of land, form of movement, manner of gripping and blade type. It was found that required operation of the equipment/tool is with in the acceptable limits of the operator. Any problem was not found during operation.

Handle

There was enough space to admit all four fingers and thumb.

Shape of handle was appropriate, for power grip, design for maximum surface contact, so as to minimize unit pressure of the hand. Handle was made up of wood. It was readily available, easily worked, good resistance to shack and good frictional quality. Angulations of tool handles may be necessary to maintain a straight wrist. The handle should reflect the axis of grasp. It was appropriate in land leveller.

When levelling of land was done with the help of land leveller, physiological cost of work in terms of heart rate, energy expenditure, muscular stress, postural stress and body discomfort were less as compared to when levelling of land was done manually.

It is therefore; felt that with sufficient practice there would be more output. There is a need of minor modification in length of handle and in grip.

Hand Scrapers

It was used for spreading of manure. It was made up of wood and iron. Length of the handle was 120.0 cm. Circumference of handle (width) was 4.50 cm. There was no adjustment function in handle and blade. Blade was horny in structure; length of the blade was 30 cm. There was no wheel.

Mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0±0.31 cm (8.8 cm and 12.5 cm), 7.5 ±0.12cm

(6.0 cm and 8.9 cm) and 3.5±0.07cm. (3.0 cm and 4.0 cm), respectively. Mean height of elbow as 102.8 ± 4 38 cm with 5^{th} and 95^{th} percentile i.e. 97.3 cm and 107.4 cm respectively.(table4.10) It was found that length of handle was slightly more as compared to mean elbow height of women farmers.

The physiological cost in terms of heart rate was less as compared to traditional technology (activity was done manually). Energy expenditure, TCCW posture stress, muscular stress and body discomfort. Output was more as compared to spreading of manure was done by manually. It was observed that the subjects were in a better body posture i.e. standing cum bending posture, angle of deviation was less in upper and in lower back.

There was a direct interrelation between spreading of manure form of movement, manner of gripping and blade type. It was found that required operation of the equipment/tool within the acceptance limits of the operator. No problem was found during operation.

Handle

There was enough space to admit all four fingers and thumb. Shape of handle was appropriate, for power grip, design for maximum surface contact, so as to minimize unit pressure of the hand. Handle was made up of wood; it was readily available, easily worked, good resistance to shack and good frictional quality. Angulations of tool handles may be necessary to maintain a straight wrist. The handle should reflect the axis of grasp. It was appropriate in hand scraper.

When application of manure was done with the help of hand scraper, physiological cost of work in terms of heart rate, energy expenditure, muscular stress, postural stress and body discomfort were less as compared application of manure manually.

Table no. 4.28 Ergonomic Assessment of Modified Hand Scraper

Sr. No.	Implements/Tool	Remark
1.	Name of the implements/tool	Hand Scraper
2.	Operation for which used	Spreading manure
3.	Details of handle	
(i)	Length	120 cm
(ii)	Width	4.5cm
(iii)	Height	-
(iv)	Material	Wood
(v)	Details of adjustment	No adjustment
(vi)	Diameter	
4.	Details of blade	
(i)	Size and shape	Length 30 cm and horny structure
(ii)	Material	Iron
(iii)	Maintenance	-
(iv)	Protection and safety	-
5.	Details of wheel	Not required
6.	Tool as a whole	
(i)	Dimensions	-
(ii)	Shape and Construction	Well-constructed, horny structure.
(iii)	Material	Iron
(iv)	Maintenance	-
(v)	Protection and safety	-
7	Subject Feedback	
(i)	Whether the equipment is suitable to the body dimension of the operator.	No
(ii)	Does the required operation of the equipment is within the acceptance limits of the operator.	No
(iii)	Does the operator face any problems during operations?	No
(iv)	Is there any breakdown, repair and maintenance problem during work?	No
(v)	Overall comments of the subjects about implement/tool.	No

Fig 4.44 Application of Manure with Hand Scraper

Fig 4.45 Application of Manure with Traditional Method

Hand Wheel Seeder (Maize Seeder)

It was used for sowing of maize seed. It was made up of iron. Overall height of seeder was 40 cm. There was no adjustment function in handle and blade. Blade was sharp and pointed. Length of blade was 14.5 cm. There was one wheel.

Mean height of elbow as 102.8 ± 4.38 cm with 5^{th} and 95^{th} percentile i.e. 97.3 cm and 107.4 cm respectively. Mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0 ±0.31 cm (8.8 cm and 12.5 cm), 7.5 ±0.12 cm (6.0 cm and 8.9 cm) and 3.5 ±0.07 cm (3.0 cm and 4.0 cm), respectively.(table, 4.10)It was found that height of tool was more as compared to mean elbow height of women farmers. The physiological cost in term of heart rate was more as compared to traditional technology (kudal), and output was also more.

Energy expenditure, TCCW posture stress, muscular stress and body discomfort were more while sowing was done with the help of hand wheel seeder. Although subjects were in standing posture, angle of deviation was less in upper and in lower back.

There was a direct interrelation between sowing of seed, form of movement, manner of gripping and blade type. It was found that required operation of the equipment/tool with in the acceptance limits of the operator. No problem was found during operation.

There is a need to evaluate and modify in maize seeder thoroughly from ergonomically aspects so as to suggest design modification.

Table no. 4.29 Ergonomic Assessment of Modified Hand Wheel Seeder

Sr. No.	Implements/Tool	Remark
1.	Name of the tool	Maize seeder (hand wheel seeder)
2.	Operation for which used	Sowing of maize seed
3.	Details of handle	
(i)	Length	-
(ii)	Width	-
(iii)	Height	120 cm
(iv)	Material	Iron
(v)	Details of adjustment	No adjustment
(vi)	Diameter	-
4.	Details of blade	14.5 cm
5.	Details of wheel	One wheel
(i)	Diameter	40.00 cm
(ii)	Width	-
(iii)	Material	Iron
(iv)	Speed of travel	Depends upon subject
6.	Tool as a whole	
(i)	Dimensions	-
(ii)	Shape and Construction	Well-constructed
(iii)	Material	Iron
(iv)	Maintenance	-
(v)	Protection and safety	-
B	Subject Feedback	
1.	Whether the equipment is suitable to the body dimension of the operator.	Yes
2.	Does the required operation of the equipment is within the acceptance limits of the operator.	Yes
3.	Does the operator face any problems during operations?	No
4.	Is there any breakdown, repair and maintenance problem during work?	No
5.	Overall comments of the subjects about implement/tool.	-

Fig 4.46 Modified technology for Sowing (Hand wheel seeder)

Fig 4.47 Sowing of Seed with Traditional Method

Tubular maize Sheller

It was used for shell maize form dehusked cobs. There were no handle and wheel. There was four sharp tapered fine riveted to it's inner side or periphery.

Tool was suited to the body dimensions. Length of tubular maize sheller was about 7 cm and diameter was 7.5 cm. Mean handgrip length was 7.5 ± 0.12 cm with 5^{th} and 95^{th} percentile were 6.0 cm and 8.9 cm, respectively.(Table,4.10)

There were slight variations in physiological cost of work in terms of heart rate, postural stress energy expenditure and TCCW. But during this activity with maize sheller muscular stress (grip strength) and body discomfort were less as compared to when this activity was done manually. Output was also more with tubular maize sheller. Women workers found the tabular maize sheller comfortable.

Sickle

This was made up of wood and Iron. It was used for harvesting, length of handle was 17.0 cm, handle was made up of wood, and there were no adjustment functions in handle and blade. Diameter of handle was 3.9 cm. Blade was made up of Iron, with sharp tooth. There was no wheel.

Mean fist length, mean hand grip length and grip inside diameter with 5^{th} and 95^{th} percentile were 10.0±0.3 cm (8.8 cm and 12.5 cm), 7.5±0.12 cm (6.0 cm and 8.9 cm) and 3.5 ±0.07cm. (3.0 cm and 4.0 cm), respectively.(Table, 4.10)

The physiological cost in terms of heart rate was less beats/min as compared to traditional sickle. Output was slightly more as compared to traditional sickle.

Table no. 4.30 Ergonomic Assessment of Modified Tubular Maize Sheller

Sr. No.	Implements/Tool	Remark
1.	Name of the tool	Tubular maize sheller
2.	Operation for which used	Operated to shell maize form dehusked cobs.
3.	Details of handle	No handle
(i)	Length	-
(ii)	Width	-
(iii)	Material	-
(iv)	Details of adjustment	-
(v)	Height	-
(vi)	Diameter	-
4.	Details of blade	Four tapered fine riveted to it's inner periphery.
5.	Details of wheel	Not required
(i)	Diameter	-
(ii)	Width	-
(iii)	Material	-
(iv)	Speed of travel	
6.	Tool as a whole	
(i)	Dimensions Length	7 cm
	Diameter	7.5 cm
(ii)	Shape and Construction	
(iii)	Maintenance	-
(iv)	Protection and safety	-
7	Subject Feedback	
(i)	Whether the equipment is suitable to the body dimension of the operator.	Yes
	Does the required operation of the equipment is within the acceptance limits of the operator.	Yes
(ii)	Does the operator face any problems during operations?	No
(iii)	Is there any breakdown, repair and maintenance problem during work?	No
(iv)	Overall comments of the subjects about implement/tool.	It was good, time saving, energy saving device for maize shelling.

Fig 4.48 Modified Technology for Dehusking Grains

(Tubular Maize Sheller)

(Source: C.I.A.E., Product Catalogue 2002)

Table 4.31 Ergonomic Assessment of Modified Sickle

Sr. No.	Implements/Tool	Remark
1.	Name of the implements	Sickle
2.	Operation for which used	Harvesting
3.	Details of handle	
(i)	Length	17.0 cm
(ii)	Width	-
(iii)	Height	-
(iv)	Material	-
(v)	Details of adjustment	-
(vi)	Diameter	3.9 cm
4.	Details of blade	
(i)	Size and shape	Sharp with tooth
(ii)	Maintenance	-
(iii)	Material	Iron
(iv)	Protection and safety	-
5.	Details of wheel	Not required
6.	Tool as a whole	
(i)	Dimensions	-
(ii)	Shape and Construction	Sharp and well constructed
(iii)	Material	Wood and Iron
(iv)	Maintenance	-
(v)	Protection and safety	-
B	Subject Feedback	
1.	Whether the equipment is suitable to the body dimension of the operator.	Yes
2.	Does the required operation of the equipment is within the acceptance limits of the operator.	Yes
3.	Does the operator face any problems during operations?	No
5.	Overall comments of the subjects about and/or operation	No

Fig 4.49 Harvesting with Modified Sickle

There was a direct interrelation between harvesting, form of movement, manner of gripping and blade type. It was found that required operation of the equipment/tool with in the acceptance limits of the operator. No problem was found during operation.

Handle

There was enough space to admit all four fingers and thumb.

Shape of handle was appropriate for power grip, design for maximum surface contact, so as to minimize with pressure of the hand. Handle was made up of wood; it was readily available, easily worked, good resistance to shock and good frictional quality. Angulations of tool handles may be necessary to maintain a straight wrist. The handle should reflect the axis of grasp. It was appropriate in land leveler.

When harvesting was done with the help of modified sickle, physiological cost of work and body discomfort was slightly less as compared to traditional sickle.

It is to be noted women farmers were using traditional sickle since childhood, whereas they had practiced with modified sickle for few days only. It was therefore, felt that with sufficient practice for more output and less body discomfort. There is a need of minor modification in diameter of handle of sickle for proper gripping.

From the entire analysis it was found that, there was need to some minor changes in length of modified hoe, kutla, land leveler , hand scraper, and some changes in dimensions hand wheel seeder on the basis of parameters of physiological cost of work and anthropometric measurements.

Testing of Hypothesis:

A number of hypotheses were formulated on the basis of objective of the study for the purpose of statistical analysis the hypotheses were formulated in null form.

HO_1 It is predicted that there is no significant relationship between attitude of women farmers towards acceptance of modified technologies in organic farming and following selected variables.

- **Personal Variables**
  Age
  Education
- **Family Variables**
  Type of family
  Size of land holding
  Number of animals and livestock
  Size of family
  Income of the family.
- **Situational Variables**
  Time spent in various activities
  Distance traveled in various activities

Co-efficient of Correlation was Computed to Test this Hypothesis

Personal Variables

Significant relationship was observed between age, educational level and attitude of women farmers towards acceptance of modified technologies. There was negative relationship between age and attitude of women farmers (Table 4.32). Thus hypothesis was rejectedin this case. It could be concluded that age and educational level of women farmers affect their attitude towards

acceptance of modified technologies. Negative co-relation was observed between age nad attitude of women farmers which showed that as the age of women farmers increased, women farmers had positive attitude towards acceptance of modified technology decreased. However positive relation was seen between education and attitude indicating that as education level increases the attitude of women farmers was favourable towards modified technology.

Table 4.32 Co-efficient of Correlation between Attitude of Women Farmers Towards Acceptance of Modified Technology and Selected Variable.

S.N.	Variables	Attitude r - value	Level of significant
1.	Personal Variables		
(a)	Age	-0.951	0.01
(b)	Education	0.932	0.01
2.	Family Variables		
(a)	Type of family	0.0314	N.S.
(b)	Size of land holding	0.924	0.01
(c)	No. of animals and livestock	0.962	0.01
(d)	Size of family	-0.012	N.S.
(e)	Income of the family	0.932	0.01
3.	Situational Variables		
(a)	Time spent in various activities	0.875	0.01
(b)	Distance traveled in various activities	0.899	0.01

Family Variables

Non significant relationship was observed between type of family and size of family with attitude of women farmers towards acceptance of modified technology. Thus hypothesis was acceptance in this case. Whereas significant positive relationship was found between size of land holding, Number of animals and livestock and income of the family and attitude of women farmers

towards acceptance of modified technology. It reflected that greater the size of land holding, number of animals and livestock and income of the family more favourable would be the attitude of women farmers towards acceptance of modified technologies (Table 4.32).

Situational variables

A positive correlation was observed between time spent, distance travelled and attitude of women towards acceptance of modified technology which showed that the more the time spent and distance travelled in activities more positive would be the attitude of women towards acceptance of modified technology.

Thus, it could be concluded that attitude of women farmers towards acceptance of modified technology is affected by age, education, size of land holding, number of animals and livestock, income of the family of the women farmers, time spend and distance traveled by women farmers . (Table 4.32)

HO_2 There is no relationship between body discomfort experienced by women farmers and following selected variables.

- **Personal variables**

  Age

  Education

- **Family variables**

  Type of family

  Size of land holding

  Number of animals and livestock

  Size of family

  Income of the family.

- **Situational variables**

  Time spent in various activities

  Distance travelled in various activities

Co-efficient of correlation was computed to test this hypothesis

Personal Variables

A positive co-relation was observed between age and body discomfort experienced by them which reflected that with increase in age of women farmers, body discomfort experienced by them also increased.

Non-significant relationship was observed between education and body discomfort experienced by them. (Table 4.33)

Family Variables

Non significant relationship was observed between size of family, type of family and body discomfort experienced by women farmers. Thus, in this case hypothesis was accepted.

A positive co-relation was observed between size of land holding, number of animals and livestock and body discomfort experience by women farmers. Thus, it could be inferred that as the size of land holding, number of animals and livestock increased, body discomfort experienced by them also increased.

Negative co-relation was observed between income of the family and body discomfort experienced by them. The reason may be due to high income women farmers adopted drudgery reducing technology for performing various agricultural activities.

Situational Variables

Significant relationship was observed between time spend and distance travelled and body discomfort experienced by women farmers. A positive relationship was found between situational variables and body discomfort by women farmers it could be concluded that as time spent and distance traveled increased the women experienced more body discomfort and fatigue. Physiological cost of work in terms of heart rate and energy expenditure increased and body discomfort experienced by women farmers also increased (Table 4.33)

Table 4.33 Co-efficient of Correlation Between Body Discomfort Experienced by Women Farmers and Their Selected Variables.

S.N.	Variables	Body discomfort r - value	Level of significant
1.	**Personal Variables**		
(a)	Age	0.598	0.01
(b)	Education	0.003	N.S.
2.	**Family Variables**		
(a)	Type of family	0.007	N.S.
(b)	Size of land holding	0.006	N.S.
(c)	No. of animals and livestock	0.211	0.05
(d)	Size of family	0.661	0.01
(e)	Income of the family	-0.663	0.01
3.	**Situational Variables**		
(a)	Time spent in various activities	0.217	0.05
(b)	Distance traveled in various activities	0.593	0.01

N. S. Not significant

HO_3 There is no relationship between age and following selected variables.

- Physical fitness index
- Ponderal index
- Physiological cost of work

Co-efficient of correlation was applied between physical fitness index and age. A significant negative correlation was observed in between PFI and age. Thus, it could be inferred that as age increased physical fitness index decreased. (Table 4.34)

Non-significant relationship was found between ponderal index and age. Thus, hypothesis was accepted in this case (Table 4.34)

Age of the respondents was correlated with various parameters of physiological cost of work i.e., heart rate, energy expenditure.

Table 4.34 Co-efficient of Correlation Between Age and Their Selected Variable

S.N.	Variables	Age	Level of significance
		r - value	
A)	Physical fitness index	-0.913	0.01
B)	Ponderal Index	0.012 NS	NS
C)	Physiological cost of work		
a)	**Heart rate**		
1.	Digging of land	0.812	0.01
2.	Levelling of land	0.861	0.01
3.	Application of manure	0.789	0.01
4.	Sowing	0.023	NS
5.	Interculture	0.850	0.01

Table 4 34 Cont...

Table 4.34 Cont...

6.	Hoeing	0.850	0.01
7.	Weeding	0.250	0.05
8.	Harvesting	0.006	NS
9.	Threshing	0.003	NS
10.	Winnowing	0.213	0.05
b)	**Energy Expenditure**		
1.	Digging of land	0.973	0.01
2.	Levelling of land	0.850	0 01
3.	Application of manure	0.781	0.01
4.	Sowing	0.005	NS
5.	Interculture	0.673	0.01
6.	Hoeing	0.793	0.01
7.	Weeding	0.597	0.05
8.	Harvesting	0.014	NS
9.	Threshing	0.021	NS
10.	Winnowing	0.531	0.05
c)	**Muscular stress**		
1.	Digging of land	0.976	0.01
2.	Levelling of land	0.950	0.01
3.	Application of manure	0.931	0.01
4.	Sowing	0.251	NS
5.	Interculture	0.789	0.01
6.	Hoeing	0.831	0.01
7.	Weeding	0.973	0.01
8.	Harvesting	0.912	0.01
9.	Threshing	0.729	0.01
10.	Winnowing	0.130	NS
d)	**Postural stress**		
1.	Digging of land	0.779	0.01
2.	Levelling of land	0.635	0.01
3.	Application of manure	0.031	NS
4.	Sowing	0.012	NS
5.	Interculture	0.712	0.01
6.	Hoeing	0.613	0.01
7.	Weeding	0.528	0.05
8.	Harvesting	0.019	NS
9.	Threshing	0.003	NS
10.	Winnowing	0.004	NS

N.S. Non significant

Heart rate and Age

Co-efficient of correlation was applied between age and heart rate of women farmers while performing various agricultural activities viz, digging of land, levelling of land, application of manure, interculture, hoeing, weeding, and winnowing, a positive correlation was observed between age and heart rate of women farmers while relationship was non – significant in case of harvesting and threshing was observed, thus it could be concluded that as the age of women farmers increased their heart rate increased during selected activities (Table 4.34)

Energy Expenditure and Age

It was observed that when co-efficient of correlation was applied between age and energy expenditure of women farmers while performing various agricultural activities, a positive correlation was observed between age and energy expenditure of women farmers while digging of land, levelling of land, application of manure, interculture, hoeing, weeding and winnowing. For other activities viz, sowing harvesting and threshing non-significant relationship was found. Thus, it could be concluded that as the age of women farmers increased their energy expenditure also increased for particular activities. (Table 4.34)

Muscular Stress

It was noted that when co-efficient of correlation was applied between muscular stress and age, non-significant relationship was found in sowing and winnowing. Other activities digging of land, levelling of land, application of manure etc. and muscular stress a positive relationship was found. Thus it could be concluded that as the age of women farmers increased their muscular stress also increased for particular activities.

Postural Stress and Age

When co-efficient of correlation was applied between age and postural stress among various agricultural activities performed by women a positive correlation was observed during digging of land, levelling of land, interculture, hoeing, weeding. For other activities this relation was observed to be non-significant. Thus, it could be inferred that the age of women farmers increased their postural stress also increased for particular activities. (Table 4.34)

HO_4 There exists no Significant Association between the Time Spent, Distance Traveled Physiological Cost of Work (Heart Rate) in Various Activities

Co-efficient of correlation was computed to test this hypothesis

Table: 4.35 Co-efficient of Co-relation between Time Spent and Physiological Cost of Work (Heart rate) in Various Activities

S.N.	Activities	Time spent ,distance traveled and Heart Rate	Level of significance
		r – value	
1.	Digging of land	0.931	0.01
2.	Levelling of land	0.912	0.01
3.	Application of manure	0.873	0.01
4.	Sowing	0.921	0.01
5.	Interculture	0.930	0.01
6.	Hoeing	0.897	0.01
7.	Weeding	0.835	0.01
8.	Harvesting	0.614	0.01
9.	Threshing	0.002	NS
10.	Winnowing	0.06	NS

N.S. Not Significant

When co-efficient of co-relation was applied between time spent and distance traveled in various agricultural activities viz, digging of land, levelling of land, application of manure, sowing, interculture, hoeing, weeding, harvesting, a positive co-relation was found between these activities. Whereas in activities of threshing and winnowing, non-significant relation was found between time spent and distance traveled (Table 4.35). This hypothesis was partially rejected.

Table: 4.36 Co-efficient of Co-relation Between Distance Traveled and Physiological Cost of Work (Heart rate) in Various Activities

Sr. No.	Activities	Distance Traveled and Physiological cost of work r – value	Level of Significance
1.	Digging of Land	0.921	0.01
2.	Levelling of Land	0.911	0.01
3.	Application of manure	0.857	0.01
4.	Sowing	0.831	0.01
5.	Interculture	0.910	0.01
6.	Hoeing	0.831	0.01
7.	Weeding	0.817	0.01
8.	Harvesting	0.731	0.01
9.	Threshing	0.001	N.S.
10	Winnowing	0.003	N.S.

N.S. Not Significant

When co-efficient of co-relation was applied between distance travelled and physiological cost of work in various agricultural activities viz. digging of land, levelling of land, application of manure, sowing, interculture, hoeing, weeding, harvesting, a positive co-relation was found between these activities. Whereas activities like threshing and winnowing, non-significant relation was found between distance traveled and physiological cost of work (Table 4.36)

HO_5 There is no Significant Relationship between Heart Rate and Energy Expenditure of Women Farmers or Various Activities

Co-efficient of Correlation was Computed to test this Hypothesis

When co-efficient of co-relation was applied between heart rate and energy expenditure of women farmers while performing selected activities viz, digging of land, levelling of land, application of manure, interculture, hoeing, weeding, a positive co-relation was found between heart rate and energy expenditure. Whereas in activity of sowing, harvesting, threshing, and winnowing non significant relation was found between heart rate and energy expenditure.

Thus, hypothesis was partially rejected. It could be concluded that as the heart rate of women farmers during performing certain activities increased the energy expenditure for those activities also increased (Table 4.37)

Table 4.37 Co-efficient of Co-relation between Heart Rate and Energy Expenditure While Performing Various Activities

S.N.	Activities	Heart rate and energy expenditure	Level of significance
		r – value	
1.	Digging of land	0.88	0.01
2.	Levelling of land	0.667	0.01
3.	Application of manure	0.631	0.01
4.	Sowing	0.017	NS
5.	Interculture	0.531	0.05
6.	Hoeing	0.610	0.05
7.	Weeding	0.581	0.01
8.	Harvesting	0.120	NS
9.	Threshing	0.013	NS
10.	Winnowing	0.016	NS

N.S. Not significant

HO_6 There is no Significant Relationship Between Heart Rate and Energy Expenditure of Women Farmers Before and While Performing Various Activities.

t-test was applied to find out the difference between heart rate and energy expenditure before and while performing various activities.

Heart Rate

t – value (table 4.38) revealed that there was significant difference at 1% level between mean score of heart rate before and while performing various activities. Thus, hypothesis was rejected. It could be inferred that there is difference in heart rate of women farmers before and while performing various agricultural activities.

Energy Expenditure

It was observed that calculated t-value was significantly different at 1% level)between mean score of energy expenditure before and while performing various activities. Thus, hypothesis was rejectedIt could be concluded that there is difference in energy expenditure of women farmers before and while performing various agricultural activities. (Table 4.38).

Table: 4.38 t-value Showing Difference Between Heart Rate and Energy Expenditure Before and While Performing Various Activities.

S.N.	Activities	Heart rate		Level of significance	Energy expenditure		Df	Level of significance
		Mean score	t-value		Mean score	t-value		
1.	Digging of land							
a)	Before activity	77.66	33.061	0.01	3.464	32.450	10	0.01
b)	During activity	138.66			13.243			

Table 4.38 Cont...

Table 4.38 Cont...

2.	Levelling of land							
a)	Before activity	78.94	22.610	0.01	3.831	21.551	10	0.01
b)	During activity	127.62			11.564			
3.	Application of manure							
a)	Before activity	80.05	21.634	0.01	4.028	26.013	10	0.01
b)	During activity	122.49			10.015			
4.	Sowing							
a)	Before activity	81.05	19.43	0.01	4.211	19.134	10	0.01
b)	During activity	117.83			10.015			
5.	Interculture							
a)	Before activity	80.88	32.012	0.01	4.046	30.129	10	0.01
b)	During activity	130.38			12.064			
6.	Hoeing							
a)	Before activity	80.66	33.019	0.01	4.105	32.015	10	0.01
b)	During activity	133.26			12.463			
7.	Weeding							
a)	Before activity	78.94	21.645	0.01	3.184	22.061	10	0.01
b)	During activity	122.33			10.728			
8.	Harvesting							
a)	Before activity	78.66	20.351	0.01	3.787	21.013	10	0.01
b)	During activity	118.99			10.200			
9.	Threshing							
a)	Before activity	79.49	27.145	0.01	3.920	25.013	10	0.01
b)	During activity	115.66			9.706			
10.	Winnowing							
a)	Before activity	78.83	26.019	0.01	3.560	23.092	10	0.01
b)	During activity	113.37			9.361			

HO_7 There is no Significant Difference in Physiological Cost of Work and Body Discomfort Before and After the Activity as Seen on Selected Parameters.

t-test was applied to find out the difference between heart rate and energy expenditure (physiological cost of work) before and after performing various activities. When women farmers were at rest

Heart Rate

t – value (table 4.39 (a)) revealed that there was non – significant relationship between mean score of heart rate and while performing various activities viz, digging of land, levelling of land, application of manure, sowing interculture, hoeing, weeding, harvesting, threshing and winnowing. Thus, hypothesis was accepted. It could be inferred that there was no significant difference in heart rate of women farmers before and after performing various agricultural activities.

Energy Expenditure

t- value (table (4.39 (a)) revealed that there was significant difference between mean score of energy expenditure before and after various activities. Thus, hypothesis was rejected. It could be inferred that there is not significant difference in energy expenditure of women farmers before and after performing various agricultural activities.

Table 4.39(a) t- Value Showing Difference Between Heart Rate, Energy Expenditure, Before and After Various Activities.

S.N.	Activities	Heart rate		Level of significance	Energy expenditure		Df	Level of significance
		Mean score	t - value		Mean score	t - value		
1.	**Digging of land**							
a)	Before activity	77.66	1.131	N.S.	3.646	1.121	10	N.S
b)	After activity	84.01			4.6379			
2.	**Levelling of land**							
a)	Before activity	78.94	1.015	N.S.	3.831	1.035	10	N.S
b)	After activity	80 01			4.001			
3.	**Application of manure**							
a)	Before activity	80.05	0.983	N.S.	4.028	0.957	10	N.S.
b)	After activity	81.03			4.163			
4.	**Sowing**							
a)	After activity	81.05	0.783	N.S.	4.211	0.815	10	N.S.
b)	Before activity	81.19			4.37			
5.	**Interculture**							
a)	Before activity	80.88	0.993	N.S.	4.046	0.995	10	N.S.
b)	After activity	83.39			4.539			
6.	**Hoeing**							
a)	Before activity	80.66	1.102	N.S.	4.046	1.101	10	N.S.
b)	After activity	83.19			4.507			
7.	**Weeding**							
a)	Before activity	78.94	1.100	N.S.	4.105	0.991	10	N.S.
b)	After activity	83.14			4.499			
8.	**Harvesting**							
a)	Before activity	78.66	0.73	N.S.	3.184	0.635	10	N.S.
b)	After activity	79.34			3.895			
9.	**Threshing**							
a)	Before activity	79.94	0.739	N.S.	3.787	0.551	10	N.S.
b)	After activity	81.00			4.159			
10.	**Winnowing**							
a)	Before activity	78.83	0 739	N.S.	3.860	0.698	10	N.S.
b)	After activity	80.17			4.027			

NS – Not significant

Body discomfort

It was observed that when t –test was applied to find out the difference between body discomfort before and after performing various agricultural activities.

It was found that positive relationship between body discomfort before and after performing various agricultural activities, it was significant relationship at 0.01 level and df = 10. Thus hypothesis was rejected that body discomfort before activity was zero whereas after performing various activities viz, digging of land, levelling of land, application of manure, sowing, interculture, weeding, hoeing, threshing, harvesting and winnowing body discomfort increased. It could be inferred that there is difference in body discomfort experienced by women before and after performing various agricultural activity. (Table 4.39 (b))

Table 4.39(b) t- Value Showing Difference Between Body Discomfort, Before and After Various Activities.

S.N.	Activities	Body discomfort		df	Level of significance
		Mean score	t – value		
1.	Digging of land				
a)	Before activity	0.0		10	0.01
b)	During activity	8.21	3.394		
2.	Levelling of land				
a)	Before activity	0.0		10	0.01
b)	During activity	5.71	6.937		
3.	Application of manure				
a)	Before activity	0.0		10	0.01
b)	During activity	6.0	6.125		
4.	Sowing				
a)	Before activity	0.0		10	0.01
b)	During activity	3.4	5.931		
5.	Interculture				
a)	Before activity	0.0		10	0.01
b)	During activity	6.53	7.937		

Table 4.39 (b) Cont...

Table 4.39 (b) Cont...

6.	Hoeing				
a)	Before activity	0.0		10	0.01
b)	During activity	6.27	7.819		
7.	Weeding				
a)	Before activity	0.0		10	0.01
b)	During activity	7.50	8.913		
8.	Harvesting				
a)	Before activity	0.0		10	0.01
b)	During activity	6.33	7.378		
9.	Threshing				
a)	Before activity	0.0		10	0.01
b)	During activity	5.66	7.912		
10.	Winnowing				
a)	Before activity	0.0		10	0.01
b)	During activity	5.5	6.378		

HO_8 **There is no Significant Difference in Physiological Cost (Heart Rate) and Body Discomfort Before and After Acceptance of Modified Technology.**

Two way ANOVA was computed to test this hypothesis.

Table 4.40 Two way ANOVA test Showing Difference for Physiological Cost (Working H.R.) with Traditional and Modified Technology.

S.N.	Activities	F ratio	Level of significance
1.	Digging of land	30.50	0.01
2.	Levelling of land	0.306	0.05
3.	Application of manure	49.06	0.01
4.	Sowing	49.06	0.01
5.	Interculture	100.47	0.01
6.	Hoeing	39.71	0.01
7.	Weeding	11.36	0.05
8.	Harvesting	27.25	0.01
9.	Threshing	11.351	0.05
10.	Winnowing	28.00	0.01

It was observed that there were significant difference between in physiological cost (working heart rate) before and after acceptance of modified technology.

Thus, hypothesis was rejected. It could be concluded that working heart rate of women farmers while performing above activities accept sowing with traditional technology were more as compared to modified technology. (Table 4.40)

Table 4.41 Two way ANOVA test Showing Difference Between Physiological Cost (△H.R.) with Traditional and Modified Technology.

S.N.	Activities	F ratio	Level of significance
1.	Digging of land	10.29	0.01
2.	Levelling of land	12.81	0.01
3.	Application of manure	14.29	0.01
4.	Sowing	102.06	0.01
5.	Interculture	26.45	0.01
6.	Hoeing	7.96	0.05
7.	Weeding	6.29	0.05
8.	Harvesting	7.83	0.05
9.	Threshing	7.95	0.05
10.	Winnowing	10.98	0.01

△HR (Difference in heart rate) = Heart rate before activity – Heart rate during activities

It was observed that there was significant difference between in physiological cost (△HR) before and after acceptance of modified technology.

Thus, hypothesis wasrejected. It could be concluded that difference in heart rate of women farmers for all activities (Except sowing) with traditional technology were more as compared to modified technologies. (Table 4.41)

Table 4.42 Two way ANOVA Test Sowing Difference Between Physiological Cost (Heart Rate to Output of Work) with Traditional and Modified Technology.

S.N.	Activities	F ratio	Level of significance
1.	Digging of land	95.69	0.01
2.	Levelling of land	81.99	0.01
3.	Application of manure	106.20	0.01
4.	Sowing	59.27	0.01
5.	Interculture	48.80	0.01
6.	Hoeing	41.06	0.01
7.	Weeding	123.60	0.01
8.	Harvesting	67.16	0.01
9.	Threshing	181.84	0.01
10.	Winnowing	73.59	0.01

It was examined that above all activities performed by women farmers with traditional technologies, there was significant difference in heart rate before and after acceptance of modified technology.

Thus, hypothesis was rejected. It could be concluded that in working heart rate of women farmer while performing above activities with traditional technology, heart was more in traditional technology as compared to modified technology. (Table 4.42)

Table 4.43 Two-way ANOVA test Sowing Difference Between Body Discomfort Before and After Acceptance of Modified Technologies.

Sr. No.	Activities	F ratio	Level of Significance
1.	Digging of Land	1152.00	0.01
2.	Levelling of Land	341.33	0.01
3.	Application of manure	420.25	0.01
4.	Sowing	-768.00	0.01
5.	Interculture	840.50	0.01
6.	Hoeing	645.33	0.01
7.	Weeding	1083.00	0.01
8.	Harvesting	30102.31	0.01
9.	Threshing	1984.50	0.01
10	Winnowing	363.00	0.01

It was observed that for all activities performed by women farmers with traditional technologies, there was significant difference ($P \leq 0.01$) in body discomfort before and after acceptance of modified technology.

Thus, hypothesis was rejected. It could be concluded that body discomfort of women farmer while performing above activities with traditional technology, body discomfort was more as compared to modified technologies. (Table 4.43)

Therefore it can be concluded that physiological cost of activities and body discomfort of farmers reduced considerably after acceptance of modified technologies.