Inventory on Women Friendly Tools

ICAR- Agricultural Technology Application Research Institute (ATARI)

Indian Council of Agricultural Research

JNKVV, Jabalpur – 482004 (M.P.)

INVENTORY
ON
WOMEN FRIENDLY TOOLS

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PREFACE

Women do the most tedious and back-breaking tasks in agriculture, animal husbandry and at homes. Their contribution is very high in farm sector as they are involved in most of the farm operations and are, therefore, subjected to extra harsh conditions of work that lead to drudgery. It is generally felt that the available agricultural technologies are not women friendly as they are not designed taking into consideration the women's ergonomic measurements. There exists a gap between design engineers and farm planners and also the lack of women's access to articulate their felt needs. The result is that the women farmers have to carry out various field operations with the age-old hand tools or with their hands. The posture adopted during these operations are not proper and lead to occupational health problems if not given due attention.

It is thus essential that the tools and implements for farm women are developed to suit their body posture. In this direction, a number of agricultural implements and hand tools suitable for farm women have been developed by various Institutes under ICAR. These gender-friendly tools are required to be promoted and popularized among the farm women on a massive scale.

This inventory prepared includes the women friendly implements/equipments, their functions, specifications, brief description, benefits/ advantages and source of availability. It is presumed that introduction of women friendly improved farm tools and equipments can reduce drudgery of farm women in field operations if promoted among them.

We believe that this inventory will be of great use to researchers, home scientists, extension personnel, research and development specialists in formulating programmes related to farm women and its successful implementation.

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Authors

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INTRODUCTION

> "There is no chance for the welfare of the world unless the condition of women is improved."
>
> - Swami Vivekananda

Rural Indian women are extensively involved in agricultural activities. However, the nature and extent of their involvement differs with the variations in agro production systems. The mode of female participation in agricultural production varies with the landowning status of farm households. Their roles range from managers to landless labourers. In over all farm production, women's average contribution is estimated at 55% to 66% of the total labour with percentages, much higher in certain regions. In the Indian Himalayas a pair of bullocks works 1064 hours, a man 1212 hours and a woman 3485 hours in a year on a once hectare farm, a figure that illustrates women's significant contribution to agricultural production. (Shiva FAO, 1991)

According to Food and Agricultural Organization only 9 percent of rural Indian women own land, although 79 percent contribute as agricultural workers. In developing countries like India women are most silent participants in economic life and also an important work force in agriculture and allied fields. Because of the low literacy rate, a large section of women are compelled to work in field as labourers. The farm activities which are time and labour intensive, monotonous, repetitive and more drudgery prone are generally performed by women.

In some of the farm activities like processing and storage, women predominate so strongly that men workers are numerically insignificant. (Agarwal, 2003) Studies on women in agriculture conducted in India and other developing and under developed countries all point to the conclusion that women contribute far more to agricultural production than has generally been acknowledged. Recognition of their crucial role in agriculture should not obscure the fact that farm women continue to be concerned with their primary functions as wives, mothers and homemakers.

Besides being involved in household chores, they attend to arduous field operations like sowing, transplanting, weeding, interculturing, harvesting, threshing and agro-processing in crop production, fuel and fodder cutting, water fetching, cleaning of houses, cooking, child rearing, household maintenance and dairying/animal husbandry besides being busy in allied fields (Singh et al., 2007). Since all these operations are done manually; they cause considerable physical and mental fatigue and other health problems. The root cause of suffering of farm women is ignorance, age-old methods of doing work, inappropriateness of technology and attitudinal constraints such as innate conservation and resistance to change. During these activities they adapt unnatural

body posture due to which their physiological workload increases and also they face many types of musculoskeletal problems as a result; the efficiency of women to work decreases to a greater extent (Jyotsana et al., 2005).

For some of these operations, hand tools and equipments are available. Other operations are carried out by women workers using their hands and feet. The tools and equipments available have been primarily developed for male workers, and women workers had to adapt those whenever required to use. As a result, the output is lower and many occupational health problems also crop up. It also happens that after introduction of improved tools and equipments, the jobs predominantly carried out by women are done by male workers with equipment resulting in unemployment/ underemployment for women workers. The modern technology thus, if not given due consideration to upgrade the skill of women, it may harm them in long run rather than benefiting them (Singh et al., 2007).

Swaminathan, the famous agricultural scientist describes that it was woman who first domesticated crop plants and thereby initiated the art and science of farming. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fibre and fuel.

It is generally considered that a woman has about 2/3rd strength as that of a man. The mean values of push strength with both hands in standing posture were 226 N and 151 N for male and female workers, respectively (Gite and Majumder, 2005). For women, the aerobic capacity is also 75% of that of men. This information clearly indicates that women have different ergonomical characteristics than men. It is therefore, necessary to make the equipment suitable for women workers and due attention needs to be given, to match their capabilities and limitations, while designing equipment for use by them for various operations (Gite and Singh, 1997).

The sub centre of ICAR, CIWA, Bhopal and the AICRP on Ergonomics and Safety in Agriculture located at State Agricultural Universities have taken a lead and evaluated/ refined/ developed tools and equipments suitable for farm women. There is an urgent need to suggest the farm women about possible tools or techniques to reduce the drudgery, increase efficiency, save time, Conserve energy and enhance the quality of work life.

Methodology

Ergonomical parameters for evaluation of Drudgery

There are numbers of parameters used for evaluation or assessment of drudgery.

Heart rate

Heart rate is one of the most accurate means of studying the energy expenditure, physiological workload while performing any activity. More the workload, higher will be the heart rate. The heart rate varies from person to person and also varies during resting condition and working state. Therefore, while taking out physiological study, resting heart rate of the worker is also recorded before conducting any experiment.

Difference between working heart rate and resting heart rate gives ΔHR (beats/min) or work pulse i.e. increase in heart rate during work over rest. This parameter envisages comparison of work load of various activities carried out by a worker.

Energy Expenditure

The energy expenditure can be estimated from the heart rate, as per formula given by Varghese et al., (1994). Energy expenditure (kJ/s) = 0.159 x Average heart rate (beats/min) – 8.72.

Cardiac Cost of Work (CCW)

The cardiac cost of work can be estimated as per formula given by Varghese et al.,(1994).

CCW= ΔHR x duration of activity

Where ΔHR= Average working heart rate- Average resting heart rate

A list of equipments with brief information is presented ahead.

SOWING AND PLANTING EQUIPMENT

NAVEEN DIBBLER

Function-

This tool is used for dibbling bold seed like Maize, Soybean, Pea and Sorghum. It can also be used for gap filling. The planting operation is accomplished by pushing the jaw into the soil at desire depth and forward movement of the dibbler open the jaw to release seeds into the soils.

Specification

Overall Dimensions Length (L) x Width (W) x Height (H), mm	280X260X1060
Weight (kg)	4.0
Capacity	150m²/hr.
Cost (Rs.)	700/-
Source of Availability	CIAE, Nabibagh, Berasia Road, Bhopal-462038

Brief description

This dibbler consists of jaw type seed placement device, cell type metering mechanism, lever type power transmission system for roller and jaws and seed box with delivery system. After filling the desired seed to be sown in field, the worker should keep the dibbler at desired place and gently push the lever (front of dibbler) for opening the jaw so that seed may drop.

Benefits/advantages

- It avoids bending posture, which is generally adopted in traditional method.
- Line sowing is done with the equipment that promotes use of mechanical weeders thereby reducing drudgery and cost during weeding operation.
- Seed saving is also achieved.

Drudgery reduction aspect

- About 13% saving in cardiac cost of workers per unit of output with the dibbler as compared to traditional one.

Table 1: Performance of Naveen Dibbler for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min-	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manually Dibbling **(Farmer Practice)**	5	109	16.72	160	-	-	84	-
Dibbling by Naveen Dibbler **(Recommended Practice)**		144.8	5.75	91	65.62	34.39	15	17.86

uffers pain in Waist due to bending posture while sowing

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

PAU SEED DRILL

Function

PAU Seed Drill is used for sowing seeds of Wheat, Soybean, Maize, Gram, and Pigeon-Pea in a row.

Specifications

Overall Dimensions, (L x W x H), mm	1180x545x1050
Weight (kg)	12.7
Capacity	430 m^2/hr
Cost (Rs.)	5000/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal- 462 038.

Brief description

The PAU Seed Drill consists of a handle, hopper for seed, a ground wheel, a fluted roller and a hook for pulling the drill. The metering of seed is done with fluted roller. It has been refined for women workers using anthropometric data. PAU Seed Drill is operated from the ground wheel shaft through chain and sprocket mechanism. It needs to be operated in well -prepared field. The seed drill is operated by two workers, i.e. one for pulling and another for pushing and guiding. Rope is tied to hook provided in front of the seed drill for pulling.

Benefits/advantages

- Line sowing is done with the equipment.
- Bending posture which is generally adopted in traditional method can be avoided.
- Reduction in cost and drudgery during weeding operation.
- Seed saving is also achieved.

Drudgery reduction aspect

- Saving in cardiac cost of workers per unit of output is 87%.
- Output is increased 18 times than traditional practice.

Table 2: Performance of PAU Seed Drill for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Sowing by Broadcasting **(Farmer Practice)**	1	20	10.52	121	-	-	45	-
Sowing by PAU Seed Drill **(Recommended Practice)**		160	9.57	115	9.07	87.50	39	86.67

Suffers pain in Waist due to bending posture while sowing

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

CRRI-TWO ROW RICE TRANSPLANTER

Function

This tool is used for transplanting of 20–25 days old mat type rice seedlings (at 3-4 leaf stage) in two rows simultaneously under puddled conditions.

Specifications

Overall Dimensions (L x W x H), mm	590x690x895
Weight (kg)	14
Capacity	61 m²/hr
Cost (Rs.)	6000/-
Source of Availability	National Rice Research Institute, Cuttack, Odisha

Brief description

This equipment consists of frame, floats, seedling tray, operating handle, fingers (pickers), tray drive unit and depth control mechanism. To operate the equipment, a mat type nursery is raised. The size of mat is 22 cm in width, 45 cm in length and thickness of soil of 1.5 cm. After puddling excess water (leaving 25-50 mm of water) is drained and from next morning the equipment can be operated. The seedling mats may be loaded on the machine tray after sprinkling little water over the tray surface for smooth sliding of mat. After lifting the operating handle, it may be pushed down gently to push the seedlings kept in tray for transplanting.

Benefits/advantages

- Transplanting can be done in two rows simultaneously with the equipment.
- It avoids bending postures, It helps to remove back-pain.
- Line sowing helps in promoting the use of mechanical weeders thus drudgery and cost reduces during weeding operation.
- Saves time and labour.

Drudgery reduction aspect

- 16% saving in cardiac cost of workers per unit area.
- Workers productivity is increased by 79% as compared to traditional method.

Table 3: Performance of Two row Rice Transplanter for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Transplanting **(Farmer Practice)**	1	24	14.34	145	-	-	69	-
Transplanting by Two row Rice Transplanter **(Recommended Practice)**		55	5.43	89	62.11	56.36	13	18.84

Heavy pain in Waist due to bending posture while transplanting

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

CRRI- FOUR ROW RICE TRANSPLANTER

Function

This tool is used for transplanting of 20–25 days old mat type rice seedlings (at 3-4 leaf stage) in two rows simultaneously under puddled conditions.

Specifications

Overall Dimensions, (L x W x H), mm	820x1970x900
Weight (kg)	22.2
Capacity	245 m^2/hr
Cost (Rs.)	8000/-
Source of Availability	National Rice Research Institute, Cuttack, Odisha

Brief description

It consists of frame, floats, seedling tray, operating handle, fingers (pickers), tray drive unit and depth control mechanism. To operate the equipment, a mat type nursery is raised. The size of mat is 22 cm in width, 45 cm in length and thickness of soil of 1.5 cm. After puddling excess water (leaving 25-50 mm of water) is drained and from next morning the equipment can be operated. The seedling mats may be loaded on the machine tray after sprinkling little water over the tray surface for smooth sliding of mat. After lifting the operating handle, it may be pushed down gently to push the seedlings kept in tray for transplanting. A worker walks backward for operation of the rice trans-planter and pulls it after every stroke.

Benefits/advantages

- Avoid bending postures.
- Transplanting can be done in four rows simultaneously with the equipment.
- Line sowing helps in promoting the use of mechanical weeders thereby reducing drudgery and cardiac cost during weeding.

Drudgery reduction aspect

- About 61% saving in Cardiac cost of workers per unit area.
- Productivity of workers is increased by more than 6 times as compared to traditional method.

Table 4: Performance of Four row Rice Transplanter for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Transplanting **(Farmer Practice)**	4	150	11.95	130.00	-	-	54.00	-
Transplanting by Four row Rice Transplanter **(Recommended Practice)**		190	8.57	108.75	28.27	21.05	32.75	60.65

Heavy pain in Waist due to bending posture while transplanting

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

FOUR ROW PADDY DRUM SEEDER

Function:

This equipment is suitable for line sowing of sprouted paddy seeds in puddled field.

Specifications

Overall Dimensions, (L x W x H), mm	1555x880 x 605
Weight (kg)	7.7
Capacity	920 m2/hr
Cost (Rs.)	6000/-
Source of Availability	Department of Farm Machinery, Agricultural Engineering College & Research Institute, TNAU, Coimbatore.

Brief description

It consists of drive wheels with lugs, drive shaft, hyperboloid shaped drums and swinging type pulling beam. The hyperboloid shaped drum enables free flow of seed towards the metering holes. In between two holes a baffle is provided for filling the drum with seeds. It has 18 holes of 10 mm dia for dropping the sprouted seed in puddled field. The holes can be plugged depending on sprouted seeds and seed rate. A swinging handle is provided with the unit for pulling the seeder. After filling the drum, the lid of the drum may be closed and locked. After puddling excess water may be drained. From next morning operate the equipment at a walking speed of 1-1.5 km/h in the puddled field. The wheel impression during the previous pass will serve as a marker for the

subsequent passes. During the operation of the equipment, dropping of seeds through the holes may be observed and drums may be refilled when the drum gets empty.

Benefits/advantages

- Light in weight, and easy to transport and handle.
- Hill dropping of seed is achieved and continuous drilling is eliminated.
- Seed saving is achieved with the equipment as compared to traditional method.
- Line sowing is done with the equipment.
- Reducing drudgery and cost during weeding operation.
- Uniformity in seed sowing.

Drudgery reduction aspect

- About 61% saving in Cardiac cost of workers per unit area.
- Productivity of workers is increased by more than 6 times as compared to traditional method.

Table 5: Performance of Four row paddy drum seeder for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Sowing **(Farmer Practice)**	3	150	11.95	130.00	-	-	54.00	
Sowing by Four row paddy drum seeder **(Recommended Practice)**		850	8.57	108.75	28.27	82.35	32.75	60.65

Suffers pain in Waist due to bending posture while transplanting

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

SUGARCANE BUD CHIPPER

Function

This equipment is used for Chipping of Sugarcane Plantation .

Specifications

Overall dimensions (L x W x H), mm	555x385x1200 mm
Weight (kg)	16 kg.
Capacity	250 Buds/hour
Cost	1600/-
Source of availability	Central Institute of Agricultural Engineering, Bhopal

Brief description

The device includes a hemispheric knife actuated by a hand operated lever. One needs to place the cane on the platform and press the hand lever. After every stroke the cane needs to be rotated by 180 degree by the other hand, because the buds are at opposite sides on consequent sets. The chipped buds can be sown directly in the field.

Benefits/advantages

- Reduces sugarcane wastage
- Buds can be directly used for plantation
- Efficient chipping of sugar canes
- Chipping Rate - 250 buds/hr
- Low maintenance

Drudgery reduction aspects

- Due to this technology, the sugarcane buds can be pretested before sowing.
- It reduces cost of plantation by over 90%

Table 6: Performance of Sugarcane Bud Chhiper for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Chipping of sugarcane bud **(Farmer Practice)**	4	98	10.60	121.5			45.50	
Chipping by sugarcane bud chipper **(Recommended Practice)**		190	9.57	115	9.75	53.33	39.00	85.71

Pain in Wrist and Fingers due to manual Chipping of sugarcane bud

Indigenous Method

Reduces pain and Saves time and energy

Improved Method

WEEDING AND INTERCULTURE EQUIPMENT

HAND RIDGER

Function

For making ridges in field to sow vegetables on ridges. The equipment can also be used for making furrows in field for irrigation.

Specifications

Overall Dimensions, (L x W x H), mm	1700x540x860
Weight (kg)	2.8
Capacity	330 m^2/hr
Cost (Rs.)	700/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal.

Brief description

The equipment is suitable to be operated by farm women to make ridges and furrows for ridge planted vegetables, sugarcane planting and making field channels for irrigation. It is simple labour saving implement operated by two women for forming small ridges where crops are to be grown under irrigated conditions. It consists of a handle, ridge maker share and t-type pulling beam. Field needs to be well prepared for getting better performance of equipment for making ridges/furrows. The equipment is operated by two women workers, one for pulling and another for pushing and guiding.

Benefits/advantages

- It is helpful in avoiding bending posture which is generally adopted in traditional method with short handled tools for making ridges.
- Productivity of worker doubles with the equipment than traditional practice.

Drudgery reduction aspect

- About 67% saving in cardiac cost of worker per unit output with the ridger in comparison to the traditional method of making ridges.

Table 7: Performance of Hand Ridger for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min-	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Earthing **(Farmer Practice)**	5	80.0	15.93	155.0	-	-	79.0	-
Earthing by Hand Ridger **(Recommended Practice)**		295.0	10.52	121.0	33.95	72.88	45.0	56.96

Suffers pain in Waist due to bending posture while making ridges

Indigenous Method

Eliminates pain, avoids bending posture and reduces drudgery

Improved Method

GRUBBER WEEDER

Function

It is simple and light weight, manually operated equipment for weeding.

Specifications

Overall Dimensions, (L x W x H), mm	1750x240x 160
Weight (kg)	1.8
Capacity	70 m2/hr
Cost (Rs.)	400/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal.

Brief description

It is used for weeding and intercultural operations in row crops like Soybean, Pigeon-pea, rapeseed, chickpea etc. It is a simple and light weight, manually operated equipment for weeding and inter-culture in upland row crops. It consists of long handle, ferrule, three tynes and sweep type blades. The operator uses pull force to break the soil crust and uproot the weeds.

Benefits/advantages

- It avoids bending/squatting postures.
- Easy and comfortable to handle.
- Reduction in drudgery.
- Light in weight.
- Time saving.

Drudgery reduction aspect

- Output of this weeder was 94 per cent more than the traditional khurpi
- Minimizes the stress on the body.

Table 8: Performance of Grubber weeder for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/hr	Average of Est. Energy Expenditure kj/min-	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Weeding **(Farmer Practice)**	2	32	10.12	118.50	-	-	42.50	-
Weeding by Grubber weeder **(Recommended Practice)**		55	9.09	112	10.21	41.82	36.00	84.71

Heavy pain in Waist due to bending and squatting Posture and in Wrist due to force in the hands while weeding

Indigenous Method

Eliminates pain, avoids bending and squatting posture and reduces drudgery

Improved Method

SINGLE WHEEL HOE

Function

It is manually operated equipment for weeding and inter-culture in upland row crops spaced above 240 mm.

Specifications

Overall Dimensions, (L x W x H), mm	1790x660 x 520
Weight (kg)	9.5
Capacity	90 m^2/hr
Cost (Rs.)	600/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal.

Brief description

It consists of wheel frame, V-blade with tyne and handle. Weeds cutting and uprooting are done through push and pull action of the unit.

Benefits/advantages

- It avoids bending/squatting postures.
- Easy to maintain.
- Reduce drudgery while weeding.

Drudgery reduction aspect

- The heart rate, oxygen consumption and energy expenditure are the lowest while using this tool.
- The heart rate is reduced by 11 beats/minutes.
- Resting period is reduced from 33.33 min to 20.63 min.

Table 9: Performance of Single wheel hoe for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Weeding **(Farmer Practice)**	11	52.48	10.72	122.27	-	-	46.27	-
Weeding by Single wheel hoe **(Recommended Practice)**		89.00	7.34	101	31.55	41.04	25.00	54.03

Suffers pain in Waist due to bending and squatting Posture and in Wrist due to force in the hands while weeding

Indigenous Method

Eliminates pain, avoids bending and squatting posture and reduces drudgery

Improved Method

TWIN WHEEL HOE

Function

This tool is used for weeding and inter-culture in up-land row crops in black soil region.

Specifications

Overall Dimensions, (L x W x H), mm	1680x570 x 360
Weight (kg)	4.5
Capacity	150m2/hr
Cost (Rs.)	800/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal.

Brief description

Twin wheel hoe consists of two wheels, frame, V-blade fixed on a tyne, U-clamp and a handle. The cutting and uprooting of weeds in field is done through push and pull type action of the equipment. The equipment is operated at optimum soil moisture condition and preferably after 20-25 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance.

Benefits/advantages

- It avoids bending/squatting postures.
- Productivity of worker increased more than three times.

Drudgery reduction aspect

- About 43 % saving in cardiac cost of workers per unit of output.
- It saves 59% labour and operating time.

Table 10: Performance of Twin wheel hoe for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Weeding **(Farmer Practice)**	37	61.61	12.56	113.85	-	-	57.85	-
Weeding by Twin Wheel Hoe **(Recommended Practice)**		133.79	7.39	101.34	41.15	53.95	25.34	43.81

Indigenous Method

Suffers pain in Waist due to bending and squatting Posture and in Wrist due to force in the hands while weeding

Improved Method

Eliminates pain, avoids bending and squatting posture and reduces drudgery

CONO WEEDER

Function

Uprooting and burying of weeds in between standing rows of rice crop in wetlands.

Specification

Overall dimensions (L x W x H), mm	1800 x 100 x 1000
Weight (kg)	8.5
Capacity	120 m2/hr
Cost (Rs.)	1900/-
Source of Availability	Department of Farm Machinery, Agricultural Engineering College & Research Institute, TNAU, Coimbatore- 641 003.

Brief description

Two truncated rollers one behind other are fitted at the bottom of a long handle. The conical rollers have serrated blades on the periphery. A float provided in front portion prevents the unit from sinking into the soil. The cono weeder can also be used for trampling green manure crop in addition to weeding operation. It disturbs the top soil and increases aeration also. The equipment is operated in standing posture thus avoiding bending involved during uprooting of weeds by hands in traditional practice.

Benefits/advantages

- Bending posture is avoided thus reducing drudgery of workers in weeding operation in wetlands.
- Output is increased significantly.

Table 11: Performance of cono weeder for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/h	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Weeding **(FP)**	16	65.56	9.43	114.13	-	-	38.13	-
Weeding by Conoweeder **(RP)**		116.25	6.79	97.56	27.94	43.61	21.56	56.56

Indigenous Method

Suffers pain in Waist due to bending and squatting Posture and in Wrist due to force in the hands while weeding

Improved Method

Eliminates pain, avoids bending and squatting posture and reduces drudgery

HARVESTING EQUIPMENTS

IMPROVED SICKLE

Function

For harvesting wheat, rice, soybean, chickpea, grasses and thin stalked crops.

Specifications

Overall Dimensions (L x W x H), mm	330 x 200 x 50
Handle Dimensions (Diameter (D) x L), mm	35 x 123
Weight (kg)	0.18
Capacity	150 m2/hr
Cost (Rs.)	60/-
Source of Availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

It consists of serrated blade, ferrule and wooden handle. Cutting of crop stalk is being done with the improved (serrated) sickle by sawing action as against by impact or pulling action in case of local (plain) sickle. Due its less weight i.e. about 180 g the fatigue coming on wrist is less and the drudgery involved in harvesting is reduced as compared to local sickles which are heavier i.e. weighing about 350 g.

Benefits/advantages

- Serrated sickles do not require the sharpening of cutting edge frequently.
- It reduces the cutting force and increases the cutting efficiency.
- Blade has serrated edge, Sharpness of the blade has more efficient long life of cutting edge than the normal sickle.
- Light weight and easy to handle. Shape of blade is appropriate for cutting. Grip of handle is convenient.
- Handle and blade are fixed with a metal sheet that provides firmness to blade while cutting and ensures safety in use.

Drudgery reduction aspect

- About 15 % saving in cardiac cost of workers per unit of output with Serrated Sickle as compared to local sickle.
- It also provides safety to the workers due to its better construction.
- Protects the worker's hand and minimize physical stress.

Table 12: Performance of Improved sickle for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Harvesting by simple sickle **(Farmer Practice)**	31	90.86	14.34	145.00	-	-	69.00	
Harvesting by improved Sickle **(Recommended Practice)**		107.66	5.43	88.97	62.15	15.61	12.97	18.79

Pain in Waist, Shoulder and Wrist due to constant changes in posture

Indigenous Method

Eliminates pain, avoids constant changes in posture and reduces drudgery

Improved Method

COTTON STALK PULLER (WHEEL TYPE)

Function

To uproot cotton plant stalks from soil.

Specifications

Overall Dimensions (L x W x H), mm	1530x250x 500
Weight (kg)	13.5
Capacity	280m^2/hr
Cost (Rs.)	1200/-
Source of Availability	Department of Farm Machinery, Agricultural Engineering College of Research Institute, TNAU, Coimbatore.

Brief description

The cotton stalk puller consists of long handle designed in such a way that when the handle is moved downwards, the front jaws firmly hold the stalk due to press plate hinged at the bottom of the main frame. On further downward movement the press plate acts as a pivot and the front jaw portion gets lifted up along the stalk. Once the operation is over the press plate comes to its original position with help of a tension spring fitted between press plate and mainframe. The unit can easily be moved to next plant with the help of ground wheel.

Benefits/advantages

- Bending postures is avoided and chances of backache are reduced.

Drudgery reduction aspects

- It reduces the drudgery as the operation does not involve bending posture and chances of backache of workers are minimized.
- It reduces backbone pain.

Table 13: Performance of Cotton Stalk Puller (Wheel Type) for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Pulling **(Farmer Practice)**	2	132	11.16	125.00	-	-	49.00	-
Pulling by Cotton Stalk Puller (Wheel Type) **(Recommended Practice)**		236	7.50	102.00	32.78	44.07	26.00	53.06

Heavy pain in Backbone due to bending posture while harvesting of Cotton

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

COTTON STALK PULLER (JAW TYPE)

Function

To uproot cotton plant stalks from soil. This helps in field prepration and other activity in these fields.

Specification

Overall dimensions (L x W x H), mm	385 x 150 x 1340
Weight, kg	5
Capacity	46 m^2/h
Cost	1200/-
Source of availability	Gujarat Agro Industries Corporation Ltd. Agro Service Complex, Juhapura, Sarkhej Road, Ahmadabad

Brief description

The cotton stalk puller consists of long handle designed in such a way that when the handle is moved downwards, the front jaws firmly hold the stalk due to press plate hinged at the bottom of the main frame. On further downward movement the press plate acts as a pivot and the front jaw portion gets lifted up along the stalk. Once the operation is over the press plate comes to its original position with help of a tension spring fitted between press plate and mainframe. The unit can easily be moved to next plant with the help of ground wheel.

Benefit/advantages

Bending posture is avoided thus reducing drudgery and chances of backache of workers in cotton stalk pulling operation.

Table 14: Performance of Cotton Stalk Puller (JawType) for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m2/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Pulling **(Farmer Practice)**	4	20	11.23	125.50	-	-	49.50	-
Pulling by Cotton Stalk Puller (Jaw Type) **(Recommended Practice)**		41	9.53	114.75	15.21	51.22	38.75	78.28

Heavy pain in Backbone due to bending posture while harvesting of Cotton

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

FRUIT HARVESTER

Function

Plucking of fruits from orchard trees.

Specification

Overall dimensions (L x W x H), mm	160 x 120 x 1650
Plucker Unit Dimension	245
Body height, mm	120
Diameter, mm	
Weight (kg)	1.25
Capacity	420 fruit/hr
Cost	600/-
Source of availability	College of Agricultural Engineering and Technology, Dr. BSKKV, Dapoli, District Ratnagiri, Maharashtra.

Brief description

The manually operated fruit harvester consists of main body of PVC having cylindrical shape. The upper end of the body is closed and fixed with two fingers cut in V-shape and with sharp blades. An opening is provided on the body for entry of the fruits to be harvested. The bottom end of the body is open to which nylon net for collecting the fruits is tied. On the back surface of the body a metal holder is fixed to fix the aluminum pipe of required length. The length of the cutting blade was increased from 30 mm to 70 mm to increase the comfort of the worker.

Benefit/advantages

- Damage to the fruit is avoided.
- Operation is made safer as the worker does not have to climb on the tree and the chances of injury are eliminated.

Table 15: Performance of Fruit Harvester for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output fruit/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Harvesting **(Farmer Practice)**	3	250	9.19	112.67	-	-	36.67	-
Harvesting by Fruit Harvester **(Recommended Practice)**		320	7.76	103.67	15.56	21.88	27.67	75.45

Heavy pain in Backbone due to bending posture while harvesting of Cotton

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

BHINDI PLUCKER

Function

To protect worker from thorny/chemical materials during bhindi harvesting.

Brief description

It fits into the hand properly, with the help of two rings - one in thumb and another in little finger. Force to cut the pedicel is exerted by pressing these two fingers together.

Benefit/advantages

It is a tool which helps on plucking of Bhindi (Lady's finger) without causing any itching or discomfort to skin.

Specification

Overall dimensions (L x W x H), mm	140 x 95
Weight (kg)	0.15
Capacity	5-10 kg/h
Cost	35/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Table 16: Performance of Bhindi Plucker for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Plucking **(FP)**	13	2	7.95	104.84	-	-	28.84	-
Plucking by Bhindi Plucker **(RP)**		9.68	6.64	96.62	16.44	79.34	20.62	71.50

Heavy pain in Wrist & itching in skin due to harvesting of Bhindi

Indigenous Method

Reduces Wrist pain, avoids itching & discomfort to skin thus reducing drudgery

Improved Method

THRESHING EQUIPMENTS

HAND OPERATED MAIZE THRESHER

Function-

This equipment is used for threshing Maize.

Specifications

Overall dimensions (L x W x H), mm	116.8 x 69.5
Weight (kg)	75
Capacity	100kg/hr
Source of availability	Maharana Pratap University of Agriculture and Technology, Udaipur

Brief description-

This equipment consist four blades, bearings are fitted for easy movement of the handle. It has four beaters (blades) and works on beating principle. The cobs are put in the hopper and with beating acting of the blades the Maize seeds are removed from the cobs.

Benefits/advantages-

- The work efficiency is quite high.
- Save the time of worker.

Drudgery reduction aspects-

- About 68.80% saving in cardiac cost of workers.
- Saving in energy expenditure is 47.36%
- Reduction in Right hand grip fatigue is 15%.
- Reduction in Left hand grip fatigue is 13%.

Table 17: Performance of Hand Operator Maize Thresher for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min-	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Shelling **(Farmer Practice)**	1	17.25	11.31	126	-	-	50.00	-
Shelling by Hand Operator Maize Thresher **(Recommended Practice)**		88.52	6.86	98	39.35	80.51	22.00	44.00

Pain in Wrist and Fingers due to manual shelling of maize

Indigenous Method

Reduces pain and Saves time and energy

Improved Method

PADDY WINNOWER

Function

For cleaning grain after harvesting.

Brief description

This machine is easily operated and very useful for women farm workers. It consists of main frame, handle, gear mechanism, volute case, fan, hopper, outlets for clean grain and chaff. This machine can be operated by women worker by using hands in standing posture. Two women workers are required for operation of this machine, one woman operates the machine and other woman feeds the hopper and separates the cleaned grain. The machine can be easily operated by women while seating on chair or stool.

Specification

Overall dimensions (L x W x H), mm	1210x960 x 1430
Weight, kg	50
Capacity	242 kg/hr
Cost	6000/-
Source of availability	Central Rice Research Institute, Cuttack, Orissa

Benefit/advantages

- This machine can be easily operated as there no need of waiting for air flow as required in traditional cleaning.
- This machine can be operated under shade or in the workshop where grain cannot be damaged due to rain etc.

Table 18: Performance of hand operated Paddy Winnower for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Winnowing **(Farmer Practice)**	7	38.16	11.59	127.71	-	-	51.71	-
Winnowing by paddy Winnower **(Recommended Practice)**		178.29	9.11	112.14	21.37	78.60	36.14	69.89

Heavy pain in Backbone due to bending posture while paddy winnowing

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

SUNFLOWER THRESHING BUNCH

Function

This equipment is used for threshing Sunflower.

Brief description

Simple, portable threshing bench for manual sunflower threshing has been developed. The application areas are for small and medium farmers and landless labourers.

Benefits/advantages

- The work efficiency is quite high.
- Save the time of worker.
- Suitable for all sunflower varieties

Specifications

Overall dimensions (L x W x H), mm	600x600x 200
Weight (kg)	5.3
Capacity	100kg/hr
Cost	140/-
Source of availability	The Gandhigram Rural Institute (Deemed University)

Drudgery reduction aspects

- Higher threshing efficiency .
- Helps to reduce drudgery in threshing.
- Saves 60% of conventional cost per ha.

Table 19: Performance of Sunflower Threshing Bunch for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Threshing **(Farmer Practice)**	8	3.70	9.82	116.63			40.63	-
Threshing by Sunflower threshing bunch **(Recommended Practice)**		10.59	8.61	109	12.34	65.08	33.00	81.23

Pain in Wrist and Fingers due to manual Threshing of sunflower

Indigenous Method

Reduces pain and Saves time and energy

Improved Method

CLEANING / GRADING / SEPERATION EQUIPMENTS

SPIRAL SEED GRADER

Function

It is used for cleaning and grading of all round shaped grains like: Soyabean, Green peas, Green Gram, Black Gram, Bajra, Sorgam, Red Gram.

Specification

Particulars	Single Spiral Grader	Double Spiral Grader
Overall dimensions (D x W x H), mm	558.8 x 558.8 x1828.8	558.8 x 1016 x 1955.8
Weight (kg)	25-30	
Capacity	250 kg/hr	
Cost	3000-6500/-	
Source of availability	Commercially Available	

Brief description

This machine is used for grading and cleaning round shaped grains like Green Peas, Soybean, Black Gram, Sorgam, Bajra, etc. The Spiral Seed Grader is available in different specifications as per the needs of the clients.

Benefit/advantage

- Quick segregation of grains and hush.
- Same grain of different sizes can be segregated.
- Very low maintenance cost.
- Very durable, Easy to operate.
- Supreme quality, Effective output
- Highly efficient, Precisely designed, Robust construction.

Drudgery reduction aspects

- Time saving, minimizes the labour and reducing drudgery.

Table 20: Performance of spiral Seed Grader for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Worker	% Saving of cardiac Cost
Manual Seed Grading **(Farmer Practice)**	24	80	8.57	108.76	-	-	32.76	-
Seed Grading by spiral Seed Grader **(Recommended Practice)**		220.32	6.29	94.39	26.66	63.69	18.39	56.12

Pain in Back and Waist due to constant change in posture while cleaning the grain

Indigenous Method

Reduces pain, Saves time and energy

Improved Method

HANGING TYPE GRAIN CLEANER WITH SACK HOLDER

Function

For separating impurities like stubbles, chaff, dirt and broken received with grain after threshing.

Specification

Particulars	Hanging Type Cleaner	Sack Holder
Overall dimensions (L x W x H), mm	1040 x 620 x 205	530 x 450 x 810
Weight (kg)	17.1	10.3
Size of jute bag, mm	-	1120 x 680
Capacity	225 kg/hr	
Cost	5700/-	
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal	

Brief description-

It consists of main frame, grading screen, draper rod, rubber grip over handle, shutter etc. Four ropes are tied on the hooks provided on main frame of cleaner and hanged on any elevated point or hooks attached to the ceiling. It is operated in oscillating mode. The handle height of cleaner from ground should be at waist height of operator. Based on the size of grain, screen may be selected. Slow movement of cleaner is required after pouring grain on top of screen so that grain goes slowly down the cleaner box and chaff/ stubbles are remained on top of screen. After collecting the chaff from top of screen, gentle movement of cleaner is done to remove dirt, broken and finer chaff etc. present in the grain. Thereafter, it is taken out in a bag that is hanged on a sack holder by opening shutter of cleaner.

Benefit/advantages-

Apart from 63% saving in cardiac cost of worker per unit of output, the productivity of the worker increased more than four times as compared to traditional thereby reducing drudgery.

Table 21: Performance of Hanging type Grain cleaner with sack holder for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min-	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Cleaning **(Farmer Practice)**	17	75	8.09	105.72	-	-	29.72	-
Cleaning by Hanging type Grain cleaner with sack holder **(Recommended Practice)**		190.66	6.64	96.59	17.94	60.66	20.59	69.28

Pain in Back and Waist due to constant change in posture while cleaning the grain

Indigenous Method

Reduces pain, Saves time and energy

Improved Method

SHELLING / DEHULLING / PEELING EQUIPMENTS

TUBULAR MAIZE SHELLER

Function

It is a hand operated tool to shell maize from dehusked cobs.

Specification

Overall dimensions (L x W), mm	70 x 55
Shape	Octagonal
Weight (kg)	0.22
Capacity	27 kg/hr
Cost	60/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

The unit consists of galvanized mildsteel pipe with four tapered fins rivetted to its inner periphery, the sheller is held in left hand, a cob held in right hand is inserted into it with forward and backward twist, to achieve the shelling.

Benefit/advantages

- About 15% saving in cardiac cost of workers per unit of output in comparison to the traditional practice.
- The productivity of workers increased 1.6 times than traditional practice i.e. shelling with the help of sickle.
- The chances of injury to fingers are eliminated thus making the operation safer for workers.

Table 22: Performance of Tubular maize Sheller for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Shelling **(Farmer Practice)**	30	12.92	6.96	98.63	-		22.63	
Shelling by Tubler maize Sheller **(Recommended Practice)**		25.34	5.75	91.01	17.40	49.01	15.01	66.34

Indigenous Method

Suffers pain in Wrist and Fingers due to manual shelling of Maize

Improved Method

Reduces pain in Wrist and Fingers, Saves time and energy.

ROTARY MAIZE SHELLER

Function

This equipment is used for shelling maize from dehusked cob.

Specification

Overall dimensions (L x W x H), mm	555x455 x 1055
Weight (kg)	80
Capacity	73 kg/hr
Cost	6000/-
Source of availability	Sherpur Agro Industries, G.T. Road, Focal Point, Ludhiana

Brief description

It is a manually operated equipment consisting of a frame, a flywheel, a hopper and three shelling gears. With one hand a person operates the equipment whereas cobs are fed by the other hand one by one. The shelled cobs come out through the port on other side.

Benefit/advantages

- Output is very high and the equipment is suitable for farmers growing large quantity of maize.

Drudgery reduction aspects

- About 32% of cardiac cost is saved in comparison to the traditional practice.
- The chances of injury to fingers are eliminated with the use of this equipment.

Table 23: Performance of Rotary maize Sheller for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Shelling **(Farmer Practice)**	4	17	9.41	114	-	-	38.00	-
Shelling by Rotary maize Sheller **(Recommended Practice)**		65	5.27	88	43.95	73.85	12.00	31.58

Indigenous Method

Suffers pain in Wrist and Fingers due to manual shelling of Maize T

Improved Method

Reduces pain in Wrist and Fingers, Saves time and energy.

GROUNDNUT DECORTICATOR (SITTING TYPE)

Function

This is used for separating kernels from groundnut pods.

Specification

Overall dimensions (L x W x H), mm	520x 270 x 750
Weight, kg	10
Capacity	30 kg/hr
Cost	2400/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

A sitting groundnut decorticator is an oscillatory type device having cast iron shoes with projections for decortication of groundnut pods. It consist of frame, handle, oscillating arm and sieve with oblong hole. It is operated by a woman worker in sitting posture for which a stool is provided on a wooden platform. The pods are fed in batches of nearly 1.5 kg i.e. up to half of its hopper capacity so that oscillating arm can easily be operated. For proper decortication, the shoes, which are mounted on oscillating arm need to be adjusted. The women workers prefer the sitting type groundnut decorticator due to its low requirement of force and less cardiac cost.

Benefit/advantages

- About 79% saving in cardiac cost of workers per unit of output with the groundnut decorticator as compared to traditional practice.
- The productivity of workers increased tremendously than traditional practice apart from safety of workers.
- The reduction of drudgery with the equipment per kg of pods decorticated is to the tune of 74 and 79% in case of standing and sitting type decorticator respectively.

Table 24: Performance of Groundnut Decorticator (Sitting Type) for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Shelling **(Farmer Practice)**	10	3.91	9.01	111.51	-	-	35.51	-
Shelling by Groundnut Decorticator (Sitting Type) **(Recommended Practice)**		28.65	5.28	88.03	41.43	86.36	12.03	33.89

Heavy pain in Backbone due to bending posture while groundnut decortication

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

GROUNDNUT DECORTICATOR (STANDING TYPE)

Function

It is used for separating kernels from groundnut pods.

Specification

Overall dimensions (L x W x H), mm	520 x 270 x 1030
Weight (kg)	15
Capacity	35 kg/h
Cost	3500/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

It is similar in construction and principle to sitting type decorticator except that here the handle is longer and women operates the equipment in standing posture. The pods are fed in batches of 2 kg i.e. half of the hopper capacity.

Benefit/advantages

- About 74% saving in cardiac cost of workers per unit of output with the groundnut decorticator as compared to traditional practice.
- The productivity of workers increased tremendously than traditional practice apart from safety of workers.
- The reduction of drudgery with the equipment per kg of pods decorticated is to the tune of 74 and 79% in case of standing and sitting type decorticator respectively.

Table 25: Performance of Groundnut Decorticator (standing Type) for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Shelling **(Farmer Practice)**	14	3.20	9.52	114.72	-	-	38.72	-
Shelling by Groundnut Decorticator (Standing Type) **(Recommended Practice)**		29.73	6.56	96.11	31.08	89.24	20.11	51.94

Heavy pain in Backbone due to bending posture while groundnut decortication

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

GROUNDNUT STRIPPER

Function

For stripping on groundnut pods.

Specification

Overall dimensions (L x W x H), mm	690 x 690 x 200
Weight, kg	23.5
Capacity	11 kg/h/ women
Cost	2500/-
Source of availability	Department of Farm Machinery, Agricultural Engineering College & Research Institute, TNAU, Coimbatore

Brief description

The groundnut stripper consists of a square frame of vertical legs and a horizontal strip of expanded metal fixed on each side of the frame in the form of comb. The stripping of the pods is accomplished by drawing a handful of vines across the comb with a slight force. The structure facilitates its use by four women simultaneously. A small adjustable stool was fabricated for the operator to sit and perform the stripping operation. The height of the stool can be adjusted from 28-40 cm. this design eliminates knee pain and numbness while stripping in sitting posture at ground level. The frame was provided with telescopic support legs which enable the subjects to adjust the height of the frame from the ground level to suit their convenience to avoid postural discomfort. Also the hitting of the elbow against the abdomen while stripping is eliminated.

Benefit/advantages

- Higher output i.e. 350 kg of pods/day can be obtained as against 200 kg in case of conventional stripping.
- Squatting posture is avoided which minimizes stress at knee.
- About 79% saving in cardiac cost of workers per unit of output with the groundnut stripper as compared to conventional practice.

Table 26: Performance of Groundnut Stripper for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Stripping **(Farmer Practice)**	15	2.51	8.34	107.32	-	-	31.32	-
Stripping by Groundnut Stripper **(Recommended Practice)**		10.84	7.26	100.5	13	76.85	24.50	78.22

Heavy pain in Backbone due to bending posture while groundnut stripping

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

SUGARCANE STRIPPER

Function

Sugarcane Stripper is used for stripping of sugarcane.

Brief description

It is a hand tool for stripping of leaves and de-topping of cane after harvest. The stripper works by separating and pushing the leaf sheaths away from stalk. A knife is welded on the stem of the stripper for detopping of canes and for cleaning roots etc.

Specification

Overall dimensions (L x W), mm	350 x 70
Weight (kg)	0.37
Capacity	46 kg/hr
Cost	220/-
Source of availability	Indian Institute of Sugarcane Research, Lucknow

Benefit/Advantages

It helps to reduce the drudgery involved and chances of injury to workers in sugarcane stripping operation.

Table 27: Performance of Sugarcane Stripper for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Stripping **(Farmer Practice)**	4	14.25	10.04	118.00	-	-	42.00	-
Stripping by Sugarcane Stripper **(Recommended Practice)**		36.00	6.89	98.16	31.41	60.42	22.16	52.76

Heavy pain in Backbone due to bending posture while sugarcane stripping

Indigenous Method

Reduces backbone pain, avoids bending posture thus reducing drudgery

Improved Method

HOUSEHOLD PADDY PARBOILING UNIT

Function

This equipment is used to parboil paddy uniformly.

Specification

Overall Dimensions (D x H), mm	650 x 900
Capacity	125 kg/batch
Cost	4500/-
Source of availability	Agricultural Machinery & Research Centre, TNAU, Coimbatore-3

Brief description

The parboiling drum is made of galvanized iron sheet of 20 gauge thickness with a lid. The drum is divided into three equal portions. The top two-third portion retains paddy for parboiling and bottom one-third portion holds water to produce steam for parboiling. A perforated slanting sheet with perforated pipes separates the steam chamber from parboiling chamber. The lateral perforated pipes attached to the main steam pipe divides the entire parboiling chamber into a number of small compartments and helps for uniform and simultaneous parboiling of paddy. Perforated sloping floor helps for natural unloading of parboiled paddy. The water in the drum can be heated by burning firewood or any agricultural waste. After the completion of parboiling, the remaining hot water can be used for next batch.

Benefit/advantages

- Uniform parboiling and increased head rice recovery is possible besides restoration of vitamins.
- It can also be used as a storage bin, when not used for parboiling.
- Drudgery Reduction Aspects
- Paddy parboiling using improved technology (paddy par boiling unit) the heart beat rate and energy expenditure were significantly reduced.
- The time duration of carrying out this activity is reduced besides reduction in labour and energy in contrast to the indigenous method, which in turn lead to the drudgery reduction.

Table 28: Performance of House hold Paddy Parboiling unit for efficiency & drudgery reduction of Farm Women by using

Details	Number of KVK	Average of Output kg/batch	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Parboiling **(Farmer Practice)**	5	32	9.44	114.20	-	-	38.20	
Parboiling by House hold Paddy Parboiling unit **(Recommended Practice)**		105	7.42	101.52	21.36	69.52	25.52	66.81

Inflicts Pain in the Waist due to constant change in posture

Indigenous Method

Use of Paddy Parboiling Unit Reduces pain, saves time and energy

Improved Method

OTHER EQUIPMENTS

SEED TREATING DRUM

Function-

For uniform mixing of chemicals in seeds for its treatment before sowing.

Specifications

Overall Dimensions (L x W x H), mm	1190x820x1240
Weight (kg)	25
Capacity	200 kg/hr
Cost	2000/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

The seed treatment drum consists of frame, handle and cylindrical drum. The cylindrical drum is mounted on a tri-pod angle iron frame. Three pieces of mild steel flat are welded inside the drum for helping in uniform mixing. Prior to start mixing of chemicals, workers are advised for wearing plastic hand gloves and mask on nose for health protection. After adding chemicals in drum, add little water, close the lid of drum tightly and rotate the drum for 20 to 25 revolutions. After 1-2 minutes of completing the work, open the lid and take the treated seed in a separate bag/ container. A batch of 20 kg seeds takes about 5-6 minutes for complete operation i.e. filling, treating and emptying. Hand gloves and mask should not be removed till completion of the work. Children's should be kept away from the work place. After completing the work, workers are advised for thorough washing of hand, legs, face and eyes.

Benefits/advantages-

- Equipment provides safety to the worker as direct contact with chemicals is avoided.
- Uniform mixing of chemical is done.

Drudgery reduction aspects-

- It also avoids bending/squatting posture as done in traditional method of treating the seed.

Table 29: Performance of seed treatment drum for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output kg/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manually seed treatment **(Farmer Practice)**	6	75.00	9.76	116.20	-		40.20	-
Seed treatment by seed treatment drum **(Recommended Practice)**		170.00	6.39	95	34.55	55.88	19.00	47.26

Direct contact with chemical causes many health hazards

Indigenous Method

Provide safety and avoids direct contact of chemical

Improved Method

REVOLVING MILKING STOOL

Function

It is used to perform milking activity.

Specification

Overall Dimensions (H x W), cm	12 x 34
Source of availability	Punjab Agriculture University, Ludhiana

Brief description

This stool is made of iron frame and Nivar is used as woven material. It has four wheels and designed as per the sitting of the women.

Benefit/advantages

- Provision of wheels make the movement easy.
- It can be prepared locally at reasonably low cost.

Drudgery reduction aspects

- Improves the work posture from squatting to sitting.
- Reduces the physiological and muscular costs of milking activity.
- Reduces the musculo-skeletal problems while performing the activity.

Table 30: Performance of Revolving milking stool for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output lt/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual milking **(Farmer Practice)**	3	2.03	8.90	110.83	-	-	34.83	-
Milking by Revolving milking stool **(Recommended Practice)**		15.43	6.83	97.80	23.28	86.82	21.80	62.58

Indigenous Method

Pain in Waist and Back due to squatting posture while milking

Use of this Stool Reduces Waist and Back Pain, Saves time and energythus reducing drudgery

Improved Method

FERTILIZER BROADCASTER

Function

For uniform application of granular fertilizer in field.

Specifications

Overall Dimensions (D x H), mm	290 x 350
Weight (kg)	3
Capacity	11500 m^2/hr
Cost	2500/-
Source of availability	CIAE, Nabi Bagh, Berasia Road, Bhopal

Brief description

Based on observations and feed back received from women workers during the experiment with commercially available fertilizer broadcaster, the broadcaster was refined to make it suitable for them using anthropometrical data of women workers. It consists of a hopper with agitator, spreading disk, gear, crank with handle, rear cushioning pad and straps with shoulder pad for mounting. The broadcaster needs to be cross-mounted, as it is a belly-mounted equipment. A woman worker should start the broadcasting work keeping 2.5 m away from bund of field and maintain 5 m spacing during the operation in subsequent passes. The quantity of fertilizer in hopper may be observed from its transparent lid and when required it may be filled. The broadcaster may be cleaned thoroughly after use.

Benefits/advantages

- Uniform application of fertilizer is done.
- It saves workers from dust of urea at the time of application thereby enhancing safety of workers.
- Productivity of worker increased more than thrice with the equipment than traditional method.

Table 31: Performance of Fertilizer Broadcaster for efficiency & drudgery reduction of Farm Women

Details	Number of KVK	Average of Output m^2/hr	Average of Est. Energy Expenditure kj/min	Average of WHR beat/ min	Average of % reduction in drudgery	Average of % increase in efficiency	Cardiac Cost of Work	% Saving of cardiac Cost
Manual Broadcasting **(Farmer Practice)**	3	3100	7.34	101.00	-	-	25	
Broadcasting by Fertilizer Broadcaster **(Recommended Practice)**		10650	6.39	95.00	13	70.89	19	76.00

Direct contact with chemical causes many health hazards

Indigenous Method

Provide safety and avoids direct contact of chemical

Improved Method

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