

System of Rice Intensification

WEEDERS

A Reference Compendium



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Dialogue

ON WATER, FOOD AND ENVIRONMENT

System of Rice Intensification (SRI)

Rice is one of the major food crops. It feeds more than 60 percent of the world's population. Food habits, market price and other related factors are encouraging people to grow rice wherever water is available. This led to pressure on water and crop productivity resulting into increased investments on bore wells and agriculture inputs like seed, fertilizers and pesticides. These factors either independently or collectively are pushing the farmers slowly into crisis.

In such situations, System of Rice Intensification (SRI) emerged as an alternative in paddy cultivation with core principles like using less seed, less water, and less fertiliser requirement. Introduced by innovative farmers in Madagascar in early 1980s, now this is being practiced in many countries. The experiments and observations over the period reveal that there is substantial reduction in the investments on external inputs. And the productivity is usually more than the conventional rice cultivation.

"SRI is now being seen more than a set of practices (young seedlings, wider spacing, less water etc), as an opportunity for maximising production potentialities and even as a philosophy. It encourages farmer participation and innovation to make it more appropriate to local conditions and more owned by the users."

- Dr.Normon Uphoff



Weeds - Not a problem but an opportunity

Rice can grow well in standing water; but it does not require standing water as a rule. In the traditional practice water level of 2-3 inches is always maintained. This is because of the farmer's belief that rice requires more water for better growth and good yields. The other reason is not to allow emergence of weeds. But in SRI, the field is irrigated just enough to saturate the soil with moisture. Subsequent irrigation is suggested as the soil starts forming fine cracks. The irrigation interval depends on the soil type and weather conditions. This kind of water management avoids root degeneration in rice plant, increases microbial activity in the soil making the nutrients easily available to plants. It helps in healthy and better growth of roots. The roots also spread wider. However, due to intermittent wetting and drying allows the weeds to grow more rapidly and abundantly.

In SRI, weeds are not seen as a problem, but as an opportunity. As the weeds are incorporated into the soil by way of mechanical weeder, it helps build up of soil organic matter and subsequently large and diverse microbial population in the soil. Thus mechanical weeding operation facilitates the process of aeration in the soil. This inturn mobilizes the micro nutrients required for the healthy growth of the rice plant. It is estimated that about 2 tonnes of biomass is added per one acre with the incorporation of the weeds.

Intercropping for reducing weeds

It is well known that mixed cropping with several species, which fully covers the ground reduces the weeds in crops. Masanobu Fukuoka has successfully demonstrated the cultivation of paddy with berseem without any need of weeding.

In Gujarat also there is an experience of managing weeds by cultivating Berseem as an inter crop along with Paddy. Similarly suitable inter crops may be chosen as per the local conditions for effective weed management.

Weeding Advantages

- * *Enhances the utilization of biomass*
- * *Facilitates proper aeration in the soil*
- * *Promotes healthy growth of the root system and consequently the plant*
- * *Provides earthing up effect facilitating plants to produce new roots which help additional nutrients uptake*
- * *Increased yields as a result of more productive tillers, large panicle size, more number of grains per panicle and increased grain weight*

Weeding

In traditional method of rice cultivation, weeds are mostly removed from the field in a manual process as they are seen more as a negative factor for crop growth. But in SRI, weeds are seen as growth promoters when they are appropriately managed. As the weeds are more in SRI due to intermittent wetting, it is important to manage the weeds regularly. This is done by both mechanical and manual processes.

Mechanical

SRI method stimulated the creativity of several farmers wherein several efforts were made to improvise the system. Inspired farmers innovated in developing appropriate implements for SRI. The wider and equal spacing between the plants allow easy operation of mechanical weeders specifically developed for the process. This process incorporates the weeds into the soil as in green manure crops.

Presently there are many types of weeders available from simple to complex and motorized weeders. Several innovative and cost effective designs were developed and experimented according to the requirements of the farmers and soil conditions. Efforts are still on to reduce the drudgery in weeding operation.

Manual

While operating the weeder, there would be some weeds left near the rice plant. These weeds are manually removed, which is a supplemental effort to the mechanical weeding.



Weeding Process

In SRI, the first weeding is done after 10-12 days of transplantation. Subsequent weedings are done every 10 days, until the crop permits operation. Weeding at 10 day interval is necessary, even if the weeds seem to be small. If there is delay in the operation there would be problem in incorporating the weeds into the soil.

The field is irrigated one day before weeding and atleast half inch water is retained for easy operation. Weeder is moved front and back between every two rows both vertically and horizontally.

Weeder - Impact on Yields *

Some research studies have amply demonstrated that there is positive correlation between weeder use and crop yields. In the experiments conducted during 2001 – 2002, Senthilkumar (2003) compared the use of rotary weeder (five times with ten days interval from 20 days after transplanting till booting stage) with the conventional hand weeding (three times) for wet season and chemical weeding and two times hand weeding for dry season. In both the seasons, mechanical weed control significantly increased grain yields. Weeder use alone increased the plant height and enhanced the grain yield by 10.9% as compared to manual weeding. The dry matter accumulation during the growing season showed that the differences between the weed control treatments occurred primarily after flowering. The higher grain yield recorded in the use of mechanical weeder and continued stirring of soil for 5 times could be attributed to prolonged active leaves (LAI) and higher number of productive tillers.



Vijayakumar et al (2004) also found significant yield increase of 9.7% (20 x 20 cm plant density) and 11.1% (25 x 25 cm plant density) due to the weeder use when compared to conventional weeding (herbicide + hand weeding) with 14 day old seedlings and limited irrigation.

Ramamoorthy (2004) found that non-removal of left out weeds can significantly reduce the yields in weed infested lands. He also found that the stirring effect of the weeder has positive impact on the grain yield. He found that the weeder use has a sort of earthing up effect and the plants produce new roots which probably help in additional nutrient uptake.

Rajendran et al., (2005) found 22 – 24% yield increase due to weeder use.

* **Source :** 'Experimental evaluation of System of Rice Intensification in Tamil Nadu' - A research paper presented by Mr. T.M. Thiyagarajan, Tamil Nadu Agricultural University, in the National Symposium on "System of Rice Intensification - Present Status and Future Prospects, held at Hyderabad on November 17-18, 2006)

Increased productivity **

Experiments on physiological work load of women while using Manual Conoweeder (ANGRAU) in SRI Cultivation in comparison to conventional method has revealed that the cono weeders could increase the productivity of woman labour by two times and save 76% of the women's time through improvement brought into their pace of performance.

Improvement could be brought in their postures, thereby facilitating them to walk comfortably along the rows while weeding with manual cono weeder. Significant relief in muscular skeletal pains at neck and low back regions was also experienced by women, the results through the above ergonomic study is useful to establish that optimized technology could potentially enhance the pace of work and productivity of women in paddy weeding and reduce the muscular fatigue at few sensitive zones.

**** Source :** "Status and future needs of farm mechanisation in System of Rice Intensification (SRI)' - A research paper presented by P. Aum Sarma, Agricultural Research Institute (ANGRAU), Rajendranagar, Hyderabad, Sudhakar Reddy, A.P. Agroes, Hyderabad, and A. Mrunalini, Acharya N.G. Ranga Agricultural University, in the National Symposium on "System of Rice Intensification - Present Status and Future Prospects, held at Hyderabad on November 17-18, 2006.



Issues in Weeders

Various weeders are available for use in SRI, which were developed earlier. Based on a model developed by International Rice Research Institute, the Acharya N G Ranga Agricultural University of Andhra Pradesh, developed 'cono weeder'. Few innovative farmers did several experiments for different soil situations and easy operation. Even multi-row weeders were developed by some farmers. At this point of time WWF Dialogue Project and WASSAN have organised An Innovators Workshop on SRI Implements in July, 2005. After analysing various issues the Workshop made the following recommendations regarding weeders:

- * Needs to have built-in adjustability to change the width of working
- * Should have some arrangement to avoid mud getting stuck between the teeth/blades
- * Needs to be fitted with a guard
- * Should be simple in design so that it can be manufactured locally and sold at an affordable price
- * Should be made all weather-proof and durable
- * SRI farmers should have option to choose from several designs
- * A motorized version be developed to lessen fatigue/workload on the operator

Institutional

- * Lack of proper understanding on the intricacies of weed management
- * Non availability of equipment
- * Absence of decentralized manufacturing
- * A sense of increased work load among men

Weeders Bank

It might not be possible for all the farmers to have weeders (and even markers) in the initial stages of expansion of SRI. This may be either due to the cost or availability of the equipment. One way out is to establish equipment banks. A village or a group of farmers should be provisioned with certain number of weeders and markers which are to be used by the members as per their need, with appropriate norms.

What to look for in a Weeder?

Handle

Shape :

- * Should have better grip
- * Less strain on the operator
- * Easy to move (No 'pull' and 'push' factors)

Ideal shape: Inverted 'U' shape, as in a bicycle handle



Rod

length :

- * Should be appropriate to the height of the person who operates it
- * The handle should be just below the chest
- * Proper length avoids the need for either bending forward or lifting the hands to push the weeder.

Ideal rod type: Should have mechanism for adjusting the length



Shape

- * Should facilitate easy and free forward movement of the weeder.

Ideal shape: Should be angled nearer to the float

The gravity factor should reduce the downward force on the wheels and float



Weight

- * Should be light weight, so that it can be easily carried to the field, even in hilly terrains

Design

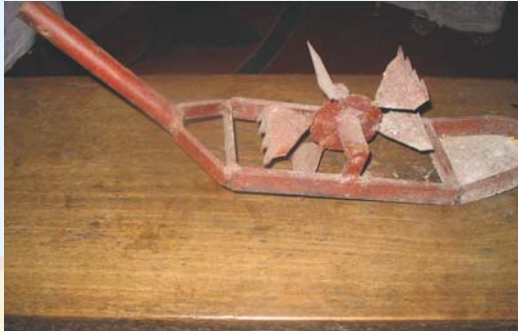
- * Should be simple so that it can be manufactured locally and in a decentralised manner





WEEDERS

Some Innovative Designs



CONO WEEDER



Developed by Acharya N.G.Ranga Agriculture University, Andhra Pradesh

Rate : Rs. 1000 (Subsidy is available, for details contact local agricultural office)

Description : It has two rotating cone shaped drums, with width adjustability
Weighs nearly 7.5 kg

Advantages

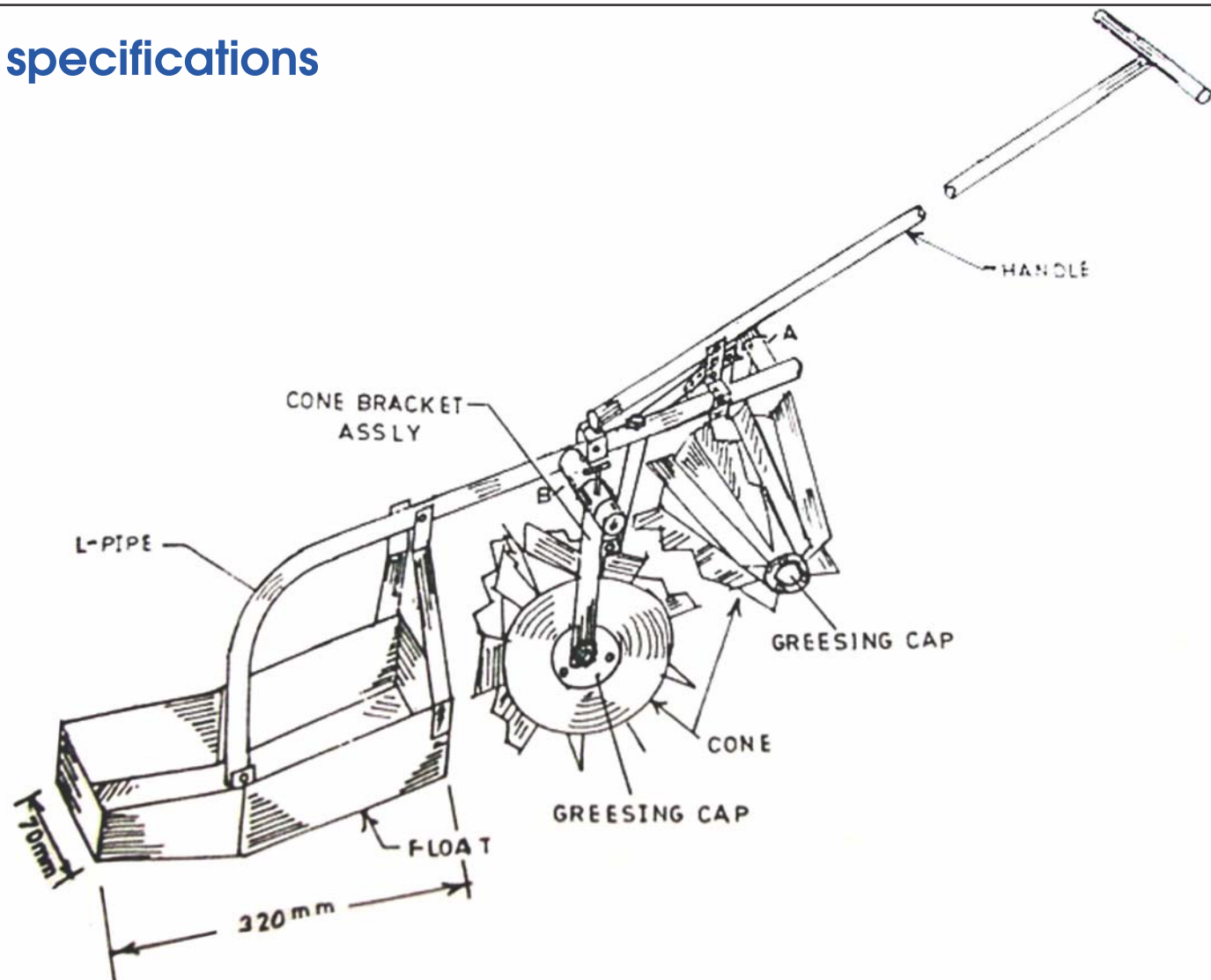
Better soil working efficiency. Operational simplicity

Limitations

Not suitable for black and loamy soils. The axle hole gets widened upon continuous use



CAD specifications



MANDAVA - Single Row Weeder

The float from the Cono-weeder, rod and handle from Kollur Weeder, the wheel from the Star Weeder and the mechanism to remove soil from the drum-plates in the Raichur weeder were integrated and adapted in designing a new weeder, which is now popularly known as Mandava Weeder.

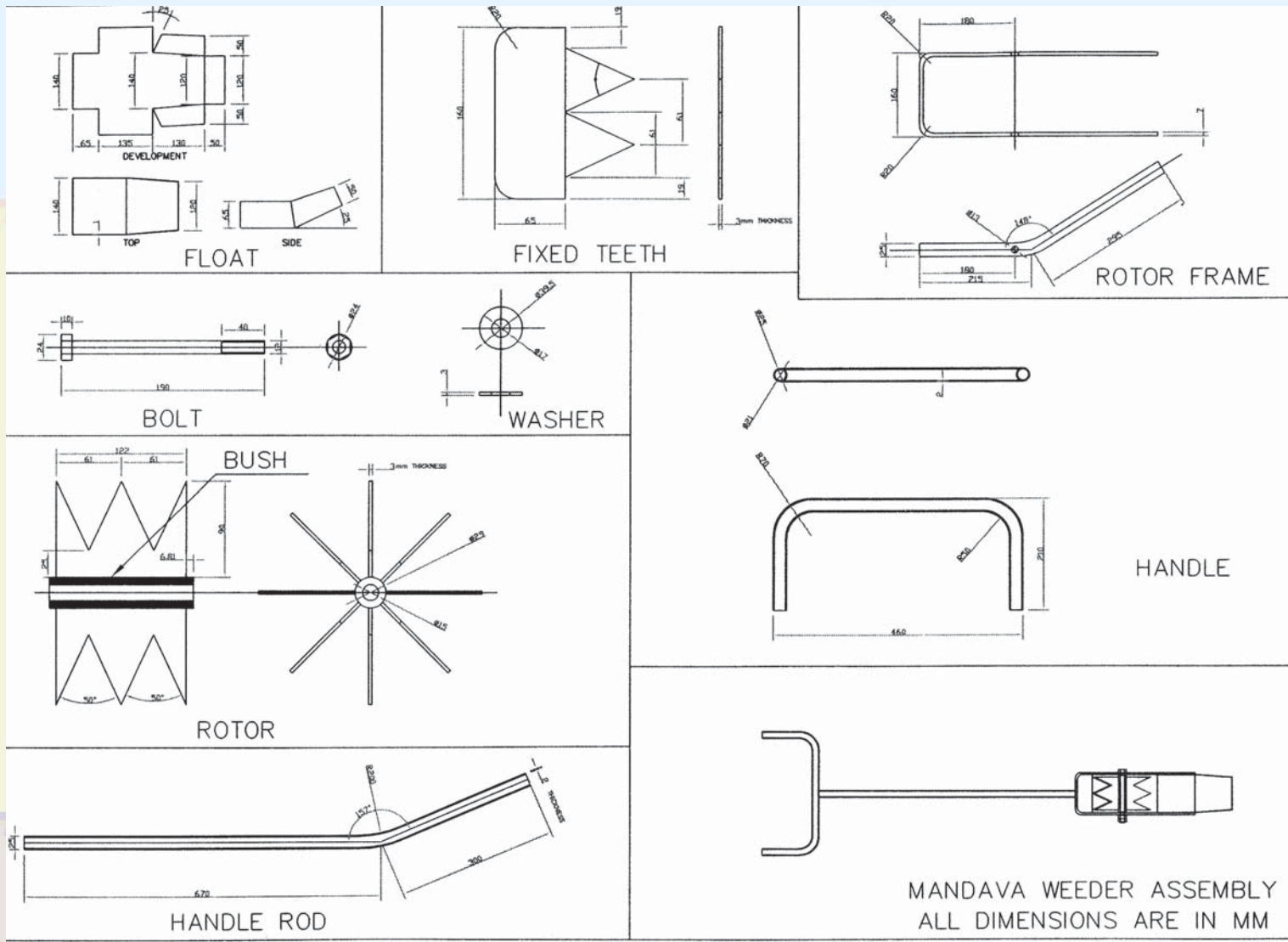


Advantages:

- Low cost (Rate : Rs 550/-)
- Less weight (5 Kgs) with more strength
- Simple Design
- Suitable to all types of soils
- Easy to operate
- Better handle
- Reduces drudgery
- Can be manufactured locally



CAD specifications *



* See the attached spread sheet for detail design specifications with measurements

MANDAVA -Two Row Weeder (in field trials)

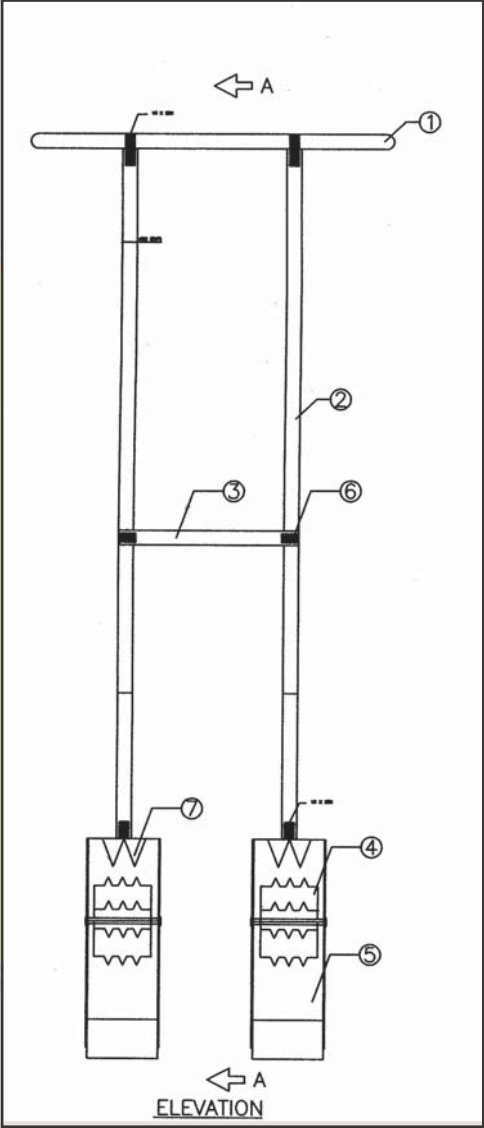
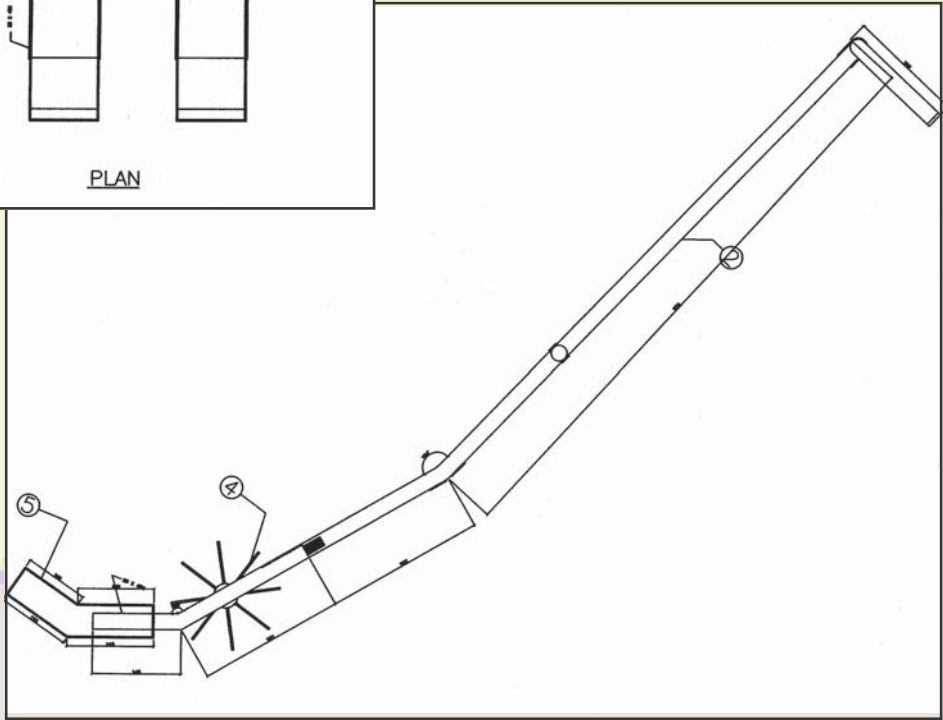
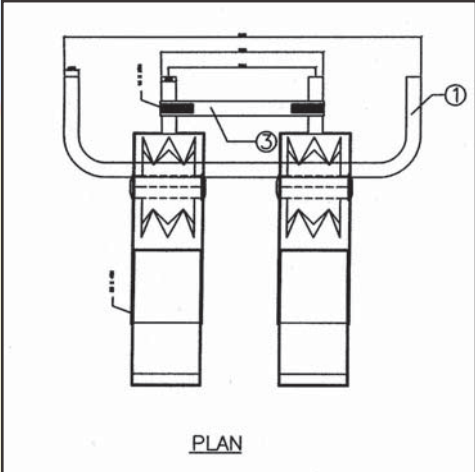


Advantages:

- Saves time for the farmers
- Low cost (Rate : Rs 1200/-)
- Light weight with more strength
- Simple Design
- Suitable to all types of soils
- Easy to operate
- Better handle
- Reduces drudgery
- Can be manufactured locally



CAD specifications *



* See the attached spreadsheet for detail design specifications with measurements

STAR WEEDER (Tharimela)

- Rate:** Rs. 400/-
- Description:** A cylindrical drum with worker-friendly handle
- Advantages:** A simple low-cost, light-weight design
- Limitations:** No provision for width adjustment



Kollur Weeder



Developed in Kollur village, Andhra Pradesh

- Rate:** About Rs. 750/-
- Description:** A Swastika-like arms fixed to an axle with a worker friendly handle
- Advantages:** Simple design and fabrication
Low weight
Soil working depth is much deeper
- Limitations:** Has a tendency to dig deeper into the soil than required thus becoming unworkable
No provision for width adjustment

Three Row Raichur Weeder



Rate Rs. 1000/-

Description Three drums placed laterally to cover three rows with to handles, one to pull in the front and another push and steer from the back.

Advantages Three row weeding by two persons results in labour saving.
Suitable to any soil.

Limiatations Needs two persons
Careful steering from the back is needed.

*Snap Shot View
of Some More
Weeders...*

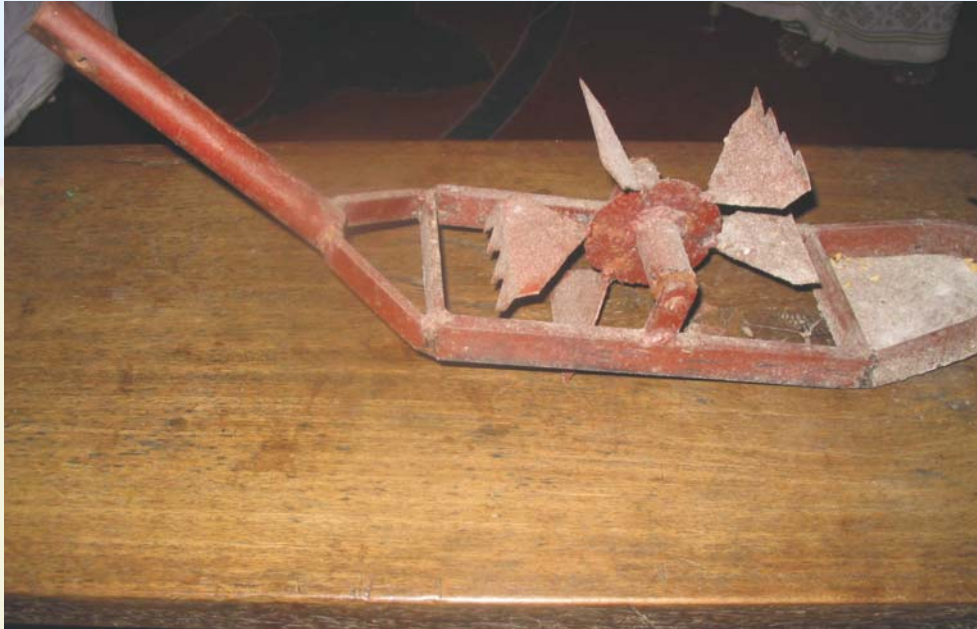


Japan Weeder

English Weeder



Tamilnadu Weeder



Single Drum Weeder

Four Row Weeder

Nepali Terai Weeder



A Reference Compendium





Jharkhand Weeder



Srilanka Weeder

Tefy Saina Weeder



Srilankan Weeder



Combodia Weeder



Mechanised Weeder



Rotating Hoe

