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Developing situation of mechanical weeding in rice

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Abstract

Maximum operations in paddy cultivation are now mechanized. Mechanization continuously improved the effectiveness of work and reduced the problem of labour shortage and also the cost of cultivation. After system of line sowing of paddy field mechanization continuously improved in weeding. This found more desirable than the manual hand picking and chemical weeding methods. Mechanical weeding done by manual weeder, animal drawn weeder and power operated weeder. Power weeders perform better than the manual and animal drawn weeders in case of reduce the cost and labour problem. Mechanical weeder and their improvement are discussed in this paper.

Keywords: Prevalent weeding, mechanical weeding, weeder

Introduction

Rice is most important crop in India, this grown in 44.4 million hectare area and production of the paddy was in 2017-18 (Anonymous, 2017) ^[1]. Population and food demand of India is increasing continuously, but due to urbanization we have limited field for production. New technologies are always helping to improve the productivity of field (Mehta *et al.*, 2019) ^[8]. Weeds are reduced the productivity of the rice. Mechanical weeding comes in trending after special sowing methods i.e. line sowing method in which plants placed in particular distance by maintain their row to row and plant to plant spacing, because mechanical weeders are not able to perform well in broad-casted paddy field. Weeding are mainly done by three methods manual hand picking, chemical weeding and mechanical weeding. Manual hand picking was time consuming and labour intensive than always. Now the emphasis is on farming without chemicals.

Review on prevalent weeding and problems

Traditional method of weeding (manual hand picking) required 400-600 man hour (Raut *et al.*, 2013) ^[11], which is uneconomical and also time consuming and drudgery involved in operation. In chemical weeding method weeds are destroyed by application of weedicide. Several chemical such as *Bromacil*, *Diuron*, *Atrazine* are apply in correct concentration for effective weeding. More protection are taken when apply chemicals, because it harmful for our skin or health. This method is broadly used by the farmers because of its effectiveness but the application of weedicide may affect the health, taste and quality of products. The major disadvantages of chemical weeding are decrease in soil fertility and helpful soil microbes. Mechanical weeding keeps the soil surface loose, which result in better aeration and better soil moisture conservation (Din *et al.*, 2014) ^[4]. In Chemical weed control method, cost of operation is half than manual hand weeding (Fagade, 1980) ^[6]. For security of food chemical can't be used in agriculture because of toxic effect. Chemicals are risky and unsafe for the living organism (Melander *et al.*, 2005) ^[9]. When we focus in environmental pollution, then the ecofriendly weed management is necessary.

Mechanical weeding

Mechanical methods of weeding are very easy and simple for adoption and understand by farmers. Traditional weeding and inter culture tools are hand hoe and spade (Yadav *et al.*, 2014). In SRI technique weeding is generally done by manually operated star cono weeder (CRRRI, TNAU design), on say rotary weeder. In rice weeding hand hoe, finger weeder, cono weeder animal drawn weeder, power tiller operated and self-propelled weeders are commercially available and used by the farmers. The more labour requirement and drudgery

associated with the operation of the manual weeders are main challenge in adoption of manual weeder. Cono weeder and rotary weeder were found suitable for wet land condition but not suitable for dry condition, and twin wheel hoe is give good performance in dry condition of SRI fields (Deshmukh *et al.*, 2011) [3]. Field capacity of animal drawn weeder is more than manual operated weeder. When animal drawn weeder was used for weeding then the many row remain untouched for weeding, and some time when the blades were clogged then the weeding was poor (Biswas *et al.*, 1999) [2]. Over the years animal population on farm is reduced due to mechanization of primary and secondary field operation and high cost maintenance of animals throughout the year. The power operated weeders are more effective than the other available mechanical weeder. In general the actual field capacity of manual weeding and power weeder was observed that 0.004 ha/h and 0.12 ha/h respectively. When power weeder and animal drawn hoe weeder compared then the power operated weeder was found more economical as compare to animal drawn hoe weeder (Padole, 2007) [10].

Effective mechanical weeders

Different manufactures, industries and scientists are developed many type of weeders for both dry and wet land paddy weeding. Simple wheel hoe weeder was used for removing the weeds in the line sowing paddy field, which was work in simple concept to cut the soil and remove weeds. It was working both dry and wet land condition of rice. Wheel cultivators are magnificent apparatuses for developing and weeding in paddy and other plants shown in Fig. 1. This is able to remove all the hardwork from working in weed removing and anticipate the overwhelming a painfulness we get from weeding with a conventional hand device. The finger weeder is able to work between the row and between the plants. It perform very well may be utilized for both upland and low land rice. The operator pushes the handle ahead and in reverse so the weeds get evacuated by the two activities. The weeder comprises of a M.S plate to which 4 bended MS bars were welded and a handle is provided to control the finger weeder. The outside fingers of both sides were bigger than the inner fingers shown in Fig. 2. The push type *ambika* paddy weeder comprises of serrated strips, float, frame and handle shown in Fig. 3. Strips are cut forcefully fit as a fiddle consistently along its length mounted on round cutting edge welded to outline (Tayade, 2016) [13]. Cono weeder was appropriate for weed cutting, agitating and mixing the weed in wet land. It covers one row in one pass. The tapered drums cut the weeds and beat them into the soil. And it is able to reduce the labour about 50-75%. The rotors were cone frustum fit as a fiddle, smooth and serrated strips were welded superficially along its length shown in Fig. 4. The rotors were mounted couple with inverse direction. In both *ambika* and cono weeder the float, rotor and handle were together mounted on a frame, where the float control the depth of weeding and reduce the problem of sinking in wet land field (Diwan, 2018) [5].

Power weeders are mostly engine operated and power is transmitted to the weeder blade through suitable transmission system in all types of power weeder. The power weeder worked on the principle of the rotational tiller. It is controlled by a little I-C motor. The basis of working of dry and wet land weeder is discussed below. Weeding in dry land condition rotary weeder sharp edges is joined to a spine mounted on a turning shaft/rotor ordinarily by nuts and fasteners shown in Fig. 5 it is also use full for wet land paddy by replacing the

wheel to attach float mechanism. Generally three types of cutting edge geometries are utilized as sharp edges for weeders and tillers specifically, L, C, and J-shaped blade. The C-shaped blade were using because of more prominent arch, with the goal that they can enter in hard field and performs well in substantial and wet soils (Singh *et al.*, 2017).



Fig 1: Wheel hoe



Fig 2: Finger weeder



Fig 3: Ambika weeder



Fig 4: Cono weeder



Fig 5: Single row weeder



Fig 8: Sai Sakthi Agrotech weeder



Fig 6: Single row dry land weeder



Fig 9: Garuda weeder



Fig 7: Two row wet land weeder



Fig 10: V-River 2 row weeder



Fig 11: Kisan Kraft paddy weeder

Table 1: Commercial available paddy weeder

Company Parameters	Sai Sakthi Agrotech	Garuda	V-River		Kisan Kraft
			3GZC-1	3GZC-2	
Power, hp	2	1.75	2	2	-
Row	1	2	1	2	2
Working width, cm	15-30	20-30 each row	17	17×2	59-60
Blade type	L type	L type	Teeth blade	Teeth blade	Teeth blade
Blade diameter, cm	-	-	-	-	45
Blade material	Special Alloy Steel	-	-	-	-
Fuel	Petrol mixed with Lub. Oil	Petrol/2str oil	Petrol / Gas	Petrol / Gas	-
Transmission	Light weight aluminum gear box	Worm and wheel type gear	-	-	Heavy duty gear
Weight, kg	14.5		20	24	17

J shape sharp edges were planned shown in Fig. 6 for the weeding activity since its better execution over C and L shape and its better mixing and pulverization Index in dry land weeding of paddy. Six cutting edges were mounted on rotor shaft of weeder. Sharp edges were planned with dimension 15 cm length and 0.5 cm thickness with cutting width of 6 cm, 7 cm, 8 cm and 9 cm (Guru *et al.*, 2018)^[7]. Weeding in two row in wet land condition is difficult, so high ground clearance weeder with special blade was developed in NRRI, Cuttack shown in Fig. 7. It consist 45 cm diameter rotor wheel in which teeth edge and flat edge blade was mounted alternatively to improve the weeding and churning of soil (Diwan, 2018)^[5]. Battery operated weeder also used but not yet impressive weeder and we need more development on that type of weeder. Beyond all this situation of weeding some weeders are commercially available and using by farmers. Specification of some commercial available paddy weeder is given in Table 1 and shown in Fig. 8 to Fig. 11.

Conclusion

Mechanical weeding in paddy is one of the potential alternatives to reduce the labour shortage in weeding operation. Minimal cost of weeding operation for rice is to be required for Indian conditions. To train workers about application of weeder would improve adoption level of the existing available weeders in field operation. Effectiveness of mechanical weeder continuously improved which creates favorable condition for plant by removing weeds. Improvement required for the battery operated and multi-row weeder.

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