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Short Communication

Evaluation of mechanical weeders in irrigated maize

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ABSTRACT

Effect of different manually operated weeders on weeds and grain yield of maize was studied. Among the manually operated weeders evaluated, wheel hoe registered an yield increase of 154% over control, took lowest weeding time (71.43 hr/ha), covered maximum area with minimum cost of operation (Rs. 714/ha) on weeding twice on 25 and 45 DAS which was on par with pre-emergence application of atrazine 0.5 kg/ha on 3 DAS followed by hand weeding on 45 DAS.

Key words: Mechanical weeders, Maize

Weeds are posing a serious problem in maize. The congenial climatic conditions encourage more weed growth in the widely spaced crop like maize (Gill *et al.* 1985) and cause yield reduction to the tune of 29 to 70 % if maize crop is not kept free during the critical period (Mani *et al*. 1968). Manual weeding with hand tools though effective in irrigated maize is not suitable due to the unavailability and more cost of labour and unfavourable climatic situation during monsoon season. Crop is weeded in general too late, leading to considerable yield reduction. Presently to substitute manual weeding, more efficient and less energy intensive manually operated weeders have been introduced for weed control in irrigated maize (Tajuddin *et al.* 1991), which are cheaper, more efficient and suitable at farmers fields to reduce the cost of production and improve crop yield to a great extent. Keeping the above fact in view, it was felt imperative to take up study on maize, to evaluate the efficiency of manually operated weeders.

A field experiment was conducted at Tamil Nadu Agricultural University, Coimbatore to evaluate the efficiency of different manually operated weeders in maize during *kharif* 2006. The soil of the experimental field was sandy clay loam in texture, low in available N (137.2 kg/ha) and phosphorus (9.0 kg/ha) and high in potassium (704.0 kg/ha). Maize variety Co-1 was sown on June 19, 2006 at a spacing of 60 cm x 20 cm. The crop was raised with all recommended package of practices. The treatments consisted of four mechanical weeding with manually operated weeders *viz.,* Crescent hoe twice at 25 and 45 DAS (T_1), Multi tyne weeder twice at 25 and 45 DAS (T_2), Wheel hoe twice at 25 and 45 DAS (T_3) and Rotary peg weeder twice at 25 and 45 DAS (T_4). The above treatments were compared with hand weeding twice at 25 and 45 DAS (T_5), atrazine 0.5 kg/ha as a pre-emergence + one hand weeding at 45 DAS (T_6) and unweeded control (T_7). The experiment was laid out in randomized block design with three replications. Atrazine 50 per cent WP at 0.5 kg/ha was sprayed using knapsack sprayer fitted with fan type WFN 40 nozzel after 3 days of sowing as pre-emergence. The weed counts and yield data of maize were recorded along with other parameters related to mechanical weeders for weeding efficiency, percent damage to crop, theoretical field capacity, actual field capacity and field efficiency. Weeders were tested using standard test procedures as specified by Regional Network for Agricultural Machinery-RNAM, 1983. The mechanical weeders were then evaluated against conventional and chemical weed control methods.

Effect on weeds

The major weed species present in the experimental field were *Echinochloa colonum* (44.92%), *Digitaria longiflora* (5.31%), *Dactyloctenium aegyptium* (3.11%), *Cyperus rotundus*(4.55%) and the annual broad leaved weeds constituted 39.64% of the total weed population comprising of *Parthenium hysterophorus* (27.77%), *Digera arvensis* (4.40%), *Trianthema portulacastrum* (3.60%). The weed density recorded in the various treatment plots at 45 DAS revealed that atrazine 0.5 kg/ha

as pre-emergence + one hand weeding at 45 DAS, hand weeding twice at 25 and 45 DAS and mechanical weeding with wheel hoe weeder were effective in minimizing the weed density (34.7 to 52.7/m^2) as compared control plot (439.3/m^2) (Table 1). However hand weeding twice was the most effective treatment as it recorded the minimum weed dry weight (106.7 kg/ha) at 45 DAS. Application of atrazine at 0.5 kg/ha followed by hand weeding at 45 DAS and mechanical weeding with wheel hoe twice also registered the lower weed dry weight (114.7 and 113.3 kg/ha). The weed biomass recorded at two stages of the crop growth (25 and 45 DAS) also showed similar trend to that of weed density under different treatments.

Effect on crop

The yield components of maize viz., the number of grains per cob were not significantly influenced by the weed control treatments (Table1). Pre-emergence application of atrazine 0.5 kg/ha followed by one hand weeding at 45 DAS recorded the maximum grain yield (5429 kg/ha) being comparable yield to hand weeding twice (5227 kg/ha). Among the mechanical weeders, weeding twice with wheel hoe recorded higher grain yield (4814 kg/ha). Kandasamy and Chandrasekhar (1998) also made similar observations due to pre-emergence application of atrazine + hand weeding in controlling the associated weeds and enhancement of maize yield.

Table 1. Effect of different weed control treatments on weed density, weed dry weight, grain yield and economics

Treatments	Weed density (No./m^2)		Weed dry weight (kg/ha)		Grains per cob	Grain yield (kg/ha)	WI (%)	B:C ratio
	25 DAS	45 DAS	25 DAS	45 DAS				
Weeding with Crescent hoe (25 and 45 DAS)	2.6 (396.7)	2.4 (255.0)	2.3 (186.7)	2.8 (693.3)	430	4059	25.23	2.08
Weeding with Multiweeder (25 and 45 DAS)	2.5 (286.0)	1.8 (62.0)	2.2 (173.3)	2.2 (140.0)	438	4615	14.99	2.39
Weeding with Wheel hoe (25 and 45 DAS)	2.4 (235.3)	1.7 (52.7)	2.2 (166.7)	2.1 (113.3)	484	4814	11.33	2.60
Weeding with Rotary peg weeder (25 and 45 DAS)	2.5 (315.3)	1.9 (69.3)	2.3 (186.7)	2.6 (353.3)	449	4345	19.97	2.18
Hand weeding twice (25 and 45 DAS)	2.3 (206.7)	1.7 (46.3)	2.2 (166.7)	2.0 (106.7)	513	5227	3.72	2.40
Atrazine 0.5 kg/ha as pre-emergence+ HW at 45 DAS	2.1 (111.3)	1.6 (34.7)	2.2 (140.0)	2.1 (114.7)	457	5429	0.00	2.87
Unweeded control	2.7 (458.0)	2.6 (439.3)	2.5 (293.3)	3.3 (2133)	380	3125	42.24	1.95
LSD (P=0.05)	0.1	0.1	0.1	0.1	37	188		NA

NA - Not analysed
Values in parenthesis are original values

Performance of weeders

Wheel hoe covered more area at both the stages of crop growth in comparison to the other weeders (Table 2).

The time taken to complete the weeding operation was less under decreased in wheel hoe (71.43 and 35.71 hr/ha) at 25 and 45 DAS respectively due to increased width (20 cm) of blades. Wheel hoe took less time probably due to rotational movement of the front wheel, which helps in ease of operation causing less fatigue to the operator and also recorded higher yield (4814 kg/ha) which was 154 per cent more over control plot. Further, wheel hoe also gave maximum area coverage with minimum cost of operation (Rs.714/ha) (Table 2) and proved most promising weeding tool for the areas where labour is costly and not easily available. Tewari and Datta (1985) also endorsed similar views from their studies.

Table 2. Performance of weeding implements at 25 and 45 DAS in irrigated maize

Treatments	Actual width of blade (cm)	Depth of cut (cm)		Speed of operation (km/ph)	Actual field capacity (ha/hr)		Field efficiency (%)		Total time taken for weeding (mandays/ha)		Weeding efficiency (%)		Damage of crop (%)	
		25 DAS	45 DAS		25 DAS	45 DAS	25 DAS	45 DAS	25 DAS	45 DAS	25 DAS	45 DAS	25 DAS	45 DAS
Weeding with Crescent hoe (25 & 45 DAS)	19.00	1.00	1.00	1.90	0.009	0.020	25.00	55.56	18.88	8.25	10.71	33.13	3.06	3.55
Weeding with Multiweeder (25 & 45 DAS)	20.00	4.00	3.00	2.00	0.012	0.023	30.00	57.50	14.42	8.44	34.62	42.86	2.37	7.11
Weeding with Wheel hoe (25 & 45 DAS)	22.00	3.00	2.80	2.10	0.014	0.028	30.43	60.87	10.93	5.46	35.99	52.96	1.96	4.57
Weeding with Rotary peg weeder (25&45 DAS)	15.00	1.50	1.40	2.00	0.007	0.017	23.33	56.67	20.86	9.85	21.42	33.97	1.93	1.89
Hand weeding twice (25 & 45 DAS)	-	-	-	-	-	-	-	-	32.00	13.00	91.78	93.72	1.30	1.85
Atrazine 0.5 kg/ha as pre-emergence+ HW at 45 DAS	-	-	-	-	-	-	-	-	-	18.00	-	-	-	-
Unweeded control	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Data not analysed statistically

The plant damage was maximum under multi type weeder (7.11%) at 45 DAS due to the bigger wheel size and therefore the worker was unable to keep the balance in proper direction within row spacing of 60 cm and hence the plant damage was more.

Rotary Peg weeder showed lower field efficiency of 23.33 and 56.67 per cent at 25 and 45 DAS, respectively, which may be because of the repeated push and pull motion during weeding operation causes too much fatigue to the operator. This weeding tool also recorded lower weeding efficiency (33.97 %) at 45 DAS and low yield (4345 kg/ ha) and hence it is not a promising weeding tool to be recommended for weeding.

Benefit cost ratio was also higher with application of atrazine at 0.5 kg/ha followed by hand weeding at 45 DAS (2.87), it was closely followed by wheel hoe weeding twice (2.60). The usage of manually operated weeders reduced the cost spent on weeding operation resulted in least cost of cultivation.

The efficiency of the operation with different types of weeders showed that wheel hoe also attained higher values in comparison to the remaining weeders.

Thus, it is inferred that mechanical weeding with wheel hoe was not only proved efficient but also useful in completing the weeding operation in lesser time.

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