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Evaluation of Two Animal - Drawn IAR Weeders under Irrigation Condition

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ABSTRACT: *Weed control is vital and important operation in crop production. The use of mechanical method in controlling these weeds is justified especially during this time in Nigeria when the alternative method (chemical) is getting beyond the reach of our peasant farmers that are the majority.In order to meet the current level of Agricultural need simple mechanical tools for weeding need to be developed. The two simple mechanical weeders developed and Evaluated in this study have given satisfactory field performances. Therecorded value for straddle row weeder field capacity was 0.30 h/hr. It also gave an average mean value of 14.85% for weeding efficiency. The weed density also affected the performance of the two implement. The Emcot attached rotary weeding also gave an average value of 0.37 h/hr for field capacity with weeding efficiencyof 24.91%.The performance of Emcot attached rotary weeder was better than that of straddle row weeder in terms of weeding efficiency.*
Keywords:- *weeding, Emcot weeder, straddle row weeder, irrigation conditions, IAR*

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I. INTRODUCTION

Agriculture is regardedas a business that sustains life. It is basically the process of food production which involve tillage operations, ploughing, harrowing, planting, weeding, and fertilizer application and finally harvesting. Harvested crops may further go into Processing for storage or into another form of food or in raw materials. Agriculture is a source of livelihood for more than half of the world population. In some countries like Nigeria, more than 70% of the in habitants support themselves by farming both fishing and raising animals, but in more advanced countries the proportion is lower, for instant in US and UK. Weed isreferred as any unwanted plants on a desired field or unwanted plants on agricultural land; this may be field for producing human consumable foods or growing grasses for raising animals. [1]Defines weeds as wild plant growing where is not wanted. Weed has always been a threat to the farmers' output and its existence on the farm will always demand farmer's attention, in most of the time it is disastrous because of its competition with the crop grown.

Weeds infestation and timeliness of weeding are some of the major factors, affecting crop production in Nigeria. In most cases, when labour demand for weeding conflict with other farming activities, weeds are left uncontrolled resulting in subtending yield reduction. Farmers all over Nigeria assume wrongly that removing weeds at any time during the growing season of a crop, solves the problem of weed competition. Because the damage done by weeds to crops before they are removed is irreversible, the time of removal is as important as removal itself. This is because; the longer the weeds compete with the crops after crop emergency the greater their effect may be, and the more the weed-related losses [2].

Weed control has become a highly specialized activity employing thousands of persons. School and Institutions teach courses in weed control and conduct researches in weed control, Industries provide the necessary technology private and public individual are engaged in the practice of weed control especially during the planting season [1]. Weeds have been a major problem to crop development and growth, which eventually have adverse effect on crop yield and behaviours at storage. Weeds sometimes labour disease and pests which also reduce the crop yield and call for extra cost. In Nigeria manual weeding is the most common method of weed control, the method has more disadvantages than the advantages it offers. The use of these methods

endangers life of crops for which weeding is being carried out, it can cause a lot of root injury and stem losses if the hoe is not carefully used. The method is inefficient, time wasting and labour intensive [3].
The objectives of this study, therefore, can be stated as follows:

i. To determine the field capacities and weeding efficiencies of the straddle row and emcot attached rotory weeder under irrigation condition.
ii. To compare the relative field performance of the above weeders under irrigation condition.

II. MATERIAL AND METHODS

2.1 Experimental site

In this study, field performance evaluation was carried out to evaluate the effectiveness of two weeders under irrigation condition. The test implement wereStraddle row weeder and Emcot attached rotory weeder with the technical specifications weight 72.1kg; length 1.1m, width1.0 m and height 1.2m and weight 98 kg; length 2.1m, width,0.65 m and weight 0.7m, respectively. A pair of work – bulls was used for the animal drawn weeders. The evaluation was conducted under ridge methods of cultivation and parameters investigated were field capacity, weeding efficiency and plant to plant.

2.2 Experimental design

For proper statistical evaluation of the parameters mentioned above, field experiment was planned using Completely Randomized Design (CRD) with factorial concept. The factors considered were weeding method with animal drawn weeders and cultivation method (ridge). The field layout of the experiment is as shown figure 1. Performance parameters mentioned were evaluated using simple statistical methods such as mean, standard deviation and coefficient of variation.

2.3Field location and preparation

The experimental field size was 0.054 hectare of land located in samara, Zaria. The land is rectangular in shape with a length and a width of 60 m and 9 m respectively. Soil test analysis confirmed it to be loam and clay loams with flat surface. The test was carried- out in ridge type of cultivation. The plot was ploughed, harrowed and finally prepared into ridge on the field layout presented in figure 1. The ridge was divided into four major parts referred to as the blocks. The dimension of each block was 20 m × 2.25 m. Each block is further divided into 14 ridges equal parts, the sizes of each ridge (60 m × 0.75 m) planted with IARSAMAT- 17 maize. The four blocks were separated from each other a distance of 0.75 m apart, weed test analysis this confirmed it to be Bamuda grass, (cynodon dactylon Linn) and Nut grass (cypresses culentum).

2.4 Devices used for data collection.

Measuring devices were used in carrying out the test. These include measuring tape for measurement of field, plots demarcation, plant to plant spacing, stop watch for time measurement, dynamometer for draft or pull measurement, weighing scale or weighing balance for measuring of soil sample collection, sample cane used to collect soil sample for the determination of soil moisture content. Core samplesfor soil sample collection and pegs for plot demarcation.

2.5 Test procedure

The performance parameters were evaluated using relevant data such as working width, plot size, weeding speed, time taken to cover each plot, percentage of plant damage and draft measurement.

2.6 Field Layout and Experimental Design

The experimental field size was 0.054 hectare of land located in samara, Zaria. The land is rectangular in shape with a length and a width of 60 m and 9m respectively. Soil test analysis confirmed it to be loam and clay loams with flat surface. The test was carried- out in ridge type of cultivation. The plot was ploughed, harrowed and finally prepared into ridge on the field layout presented in figure 1. The ridge was divided into four major parts referred to as the blocks. The dimension of each block was 20 m × 2.25m. Each block is further divided into 14 ridges equal parts, the sizes of each ridge (60 m × 0.75m) planted with IARSAMAT- 17 maize.The four blocks were separated from each other a distance of 0.75m apart, weed test analysis this confirmed it to be Bamuda grass,(cynodon dactylon Linn) and Nut grass (cypresses culentum).

REPLICATE III

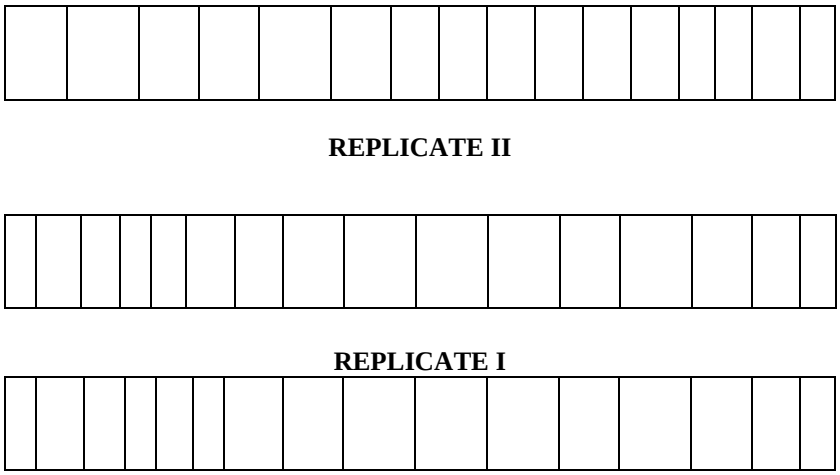

Figure: 1 Experimental field Layout

2.7 Soil Moisture Determination

Soil moisture content was determined laboratory method. Soil sample was collected each from three different locations within the experimental field. Each of samples was transferred to sampling can of known weight (W_1) and weighed immediately (W_2). The samples were oven dried at 105^{o}C for 24 hours. The soil moisture content was calculated (in percent by weight of the even dried soil) as used by [4].

$M_c = \frac{W2-W3}{W3-W1} \times 100$---------- (1)

Where,

M_c= percent moisture content (dry weight basis)

W_1 = Weight of container.

W_2 = Weight of container + wet soil.

W_3 = Weight of container + dried soil.

2.8 Weeding efficiency

The Weeding efficiency was determined for each plot after weeding, the weeding was determined by using 1m by 50cm square frame and counting the weeds within the frame, weed stand and weed removed.

$W_{ff} = \frac{RW}{SW+RW} X\ 100$ ----------(2)

Where,

W_{ff} = Weeding efficiency (%)

R_w = Removed weed

S_w = Standing weed

2.2.9 Field capacity.

Field capacity can then be determined using the relationship given by [5] as.

$F_c = \frac{A}{t}$---------- (3)

Where,

F_c = Field capacity, ha/hr

A= Area covered

T= total time / hr.

2.10 Percentage of plant damage

A plant count of the entire field was taken. The number of plants in each ridge was counted before the operation and after the operation, this is done to determine the original number and the damage number which to express as this.

$P = \frac{D}{ON} \times 100$---------- (4)

Where,

P = plant damage (%)

D = damage

ON = original Number

2.11 Draft measurement

The Draft calculated using the relationship used by [4].

$F = B\,Cos\theta and \theta = Sin^{-1}\frac{(H-h)}{L}$

Therefore $F = BCos\{sin^{-1}\frac{(H-h)}{L}\}$ ---------- (5)

Where,

F = Draft force (parallel to the ground level) (N)
B = Draft force a long line of pull (N)
O = angle of pull
H = Vertical distance from ground surface to harness point (cm)
h = Vertical distance from ground surface to draft load hitch point (cm)
L = distance between the harness point and draft load hitch point (cm).

2.12 Working principles of the two implement

Proper hitching and adjustment are important factors that will determine high or poor performance of the above implements. If high performance into be attained, the implements should be hitched properly to the source of power, the gangs, lines should be adjusted to conform to the ridge profile.

2.13 Field operation

After proper adjustment in the field, the implement should be attached by means of harness to the power source which is apiary of work bulls. The operator should insure that the centre of load, the hitch point and the centre of power pass through a straight line. The operator can now set the work bulls in motion, pull the implement for a short distance and examine the work done. If satisfactory, the operation should continue.

III. RESULTS AND DISCUSSION

The factors considered were germination stage at four different levels. First stage was 21 days after planting; second stage was 24 days, third stage was 27 days and forth stage 30 days, respectively. The summary of the results for all the parameters under consideration is as presented in Table 1, 2, 3, 4 while the comparison of the results was done using in Table 5.

3.2 Field capacity

The results for field capacity Straddle row weeder are as presented in Table 1. The results obtained varied from minimum to maximum values of 0.33and 0.36 h/hr in $B_2$and B_1, respectively at 13% moisture content. However the highest average mean values were obtained at 13.2% moisture content having the minimum and maximum values of 0.33 and 0.45%, respectively. In this case, the field capacity indicated increase with increase in moisture content.

Table 1: Summary of mean results for evaluated parameters

Block	Fc_1 (%)	Fc_2 (%)	Fc_3 (%)	Fc_3 (%)	Average
B_1	0.15	0.36	0.45	0.25	0.302
B_2	0.28	0.36	0.41	0.23	0.320
B_3	0.19	0.33	0.33	0.28	0.282
Average	0.206	0.350	0.396	0.253	0.301

3.3 Weeding Efficiency

The results are presented in Table 2. The minimum and maximum values obtained were 11.33% and 15.33%, respectively at moisture content of 13.2 and 13.0% with the overall average value of 14.83%. The weeding efficiency of the implement increased with reduction in moisture content.

Table 2: Average results for weeding efficiency

Block	We_1 (%)	We_2 (%)	We_3 (%)	We_4 (%)	Average
B_1	22	11	23	39	23.75
B_2	13	15	3	13	11.00
B_3	11	15	8	5	9.75
Average	15.33	13.66	11.33	19.00	14.83

3.4 Field capacity

FormTable 3. The results obtained for field capacity of emcot attached rotary weeder showed that highest and lowest values were 0.69 and 0.23h/hr, respectively.At 13% and 13.2%moisturecontent, the overall average mean of 0.37 h/hr was observed. The results clearly indicated that field capacity increased with reduction in soil moisture content.

Table 3: Average results for field capacity

Block	Fc_1 (%)	Fc_2 (%)	Fc_3 (%)	Fc_4(%)	Average
B_1	0.49	0.30	0.69	0.28	0.43
B_2	0.41	0.36	0.54	0.38	0.42
B_3	0.23	0.31	0.31	0.28	0.28
Average	0.37	0.32	0.50	0.31	0.37

3.5 Weeding efficiency

Table 4 shows the weeding efficiency of emcot attached rotary weeder. From the table, the average value obtained is 24.95%. Maximum and minimum values are 43 and 4%, respectively. Naturally, weeding efficiency to increase from the critical prediction, but because a lot of factors were responsible for the results obtained (Table 4) from the field like type of weed which is very disturbance weed.

Table: 4 Average weeding efficiency

Block	We_1 (%)	We_2 (%)	We_3 (%)	We_4(%)	Average
B_1	42	29	28	4	24.50
B_2	43	19	42	7	27.75
B_3	26	29	30	17	22.50
Average	37.80	25.66	33.33	9.33	24.91

The results as presented in Table 5 showed that the coefficient of variation for field capacities for both straddle row and emcot attached rotary weeder are 8.8 and 12.6%, respectively. This value is withinthe acceptable ranges of 0 to 14%. The results were further analysed using a comparison of field capacity; weeding efficiency and percentage of plant damage between the two weeders. The mean values obtained for field capacity with straddle row and emcot attached rotary weeder are 0.30 and 0.37 h/hr, respectively. However, weeding efficiencies of the above mentioned weeders are 14 and 24.91%, respectively. The highest percentages of plant damage are 6 to 7%, respectively.

Table: 5Comparison between straddle rowand emcot attached rotary weeder.

	Field cap. (ha/hr)	Weeding E_{ff} (%)	% of Plant damage
Straddle row	0.30	14.85	7.75
Emcot attached rotary	0.37	24.91	6.99
X	0.30	4.00	
SD	0.03	0.05	
CV%	8.8		

IV. CONCLUSION

The mechanical method of weed control in Nigeria yet to receive a higher priority, millions of Nigeria farmers still use the traditionalmethod of manual weeding because chemical control method which has been an alternative has now gone beyond the reach of peasant farmers. Simple mechanical weeding tools need to be developed and improved upon for higher efficiency and better weed control. The Evaluation of fabricated mechanical rotary weeders forms a contribution in the solution to the weeding problems faced by our farmers. The weeders were designed to work on a ridged or flat agricultural land and to utilize two pairs of work bulls as source of power. The average working capacities for clay loam soil is 0.30 h/hr for the Emcot attached rotary weeder and straddle row weeder is 0.37 h/hr. The soil moisture content at which the weeders were evaluated was 13% (dry basis). The weeding efficiencies for Emcot attached rotary weeder has an average of 14.85% and the percentage plant damage for both implement is between 6 to7.55%.The choice of the weeder to use among these two weeders will depend on individual the type of crops, and land condition and the availability of power required on.

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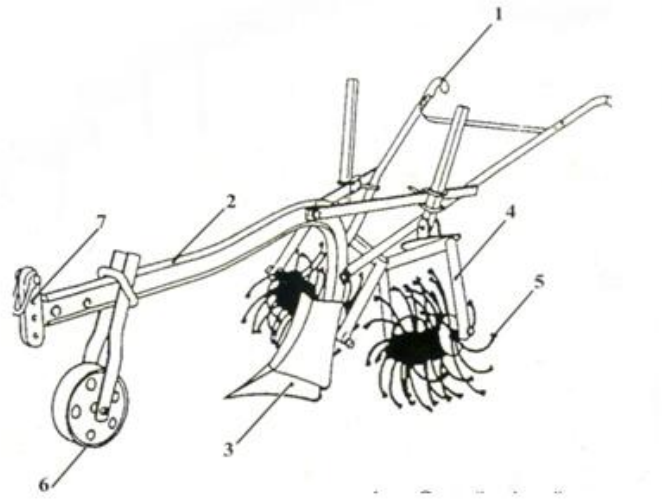
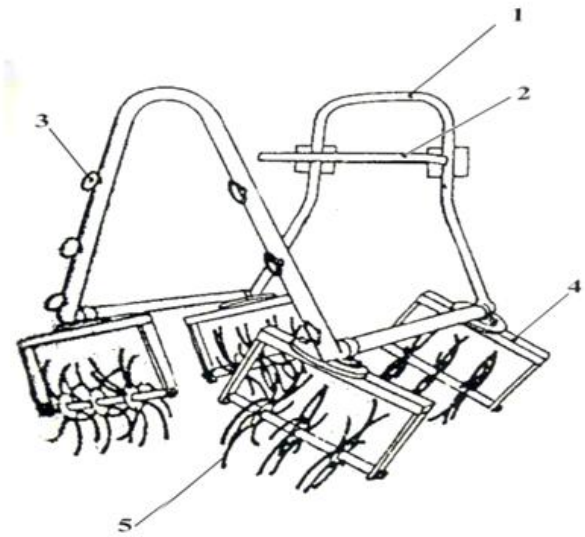
Appendix



1. Operating handle
2. Ridger frame
3. Ridger
4. Rotor bracket (gang)
5. Tine
6. Roller wheel
7. Hitch point

Figure: 3 Emcot attached Rotary Weeder



1. Straddle frame
2. Operator's seat
3. Hitch Ring
4. Rotor bracket (gang)
5. Tine

Figure: 2 Straddle Row Weeder

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