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THE COMPARATIVE EFFECTIVENESS OF THREE CULTURAL WEED CONTROL METHODS ON THE YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) IN AN ULTISOL.

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ABSTRACT: This work was carried out at the School of Agriculture and Agricultural Technology, Federal University of Technology Teaching and Research farm Owerri-Nigeria. Between 2005 to 2006 to compare effectiveness of three weed control methods and their cost differential. The treatments comprised the use of 20 tons of dry *Panicum maximum* mulch, hoe, hand weeding and unweeded plots served as (control). Okra (*Abelmoschus esculentus)* was used as the test crop. Weed control plots produced significantly($p<0.05$) taller plants and gave higher yields in okra than the unweeded (control plots). Among the weed control treatments mulched plots produced taller plants throughout the two years. The mulched plots contained significantly lesser weeds than both hoe and hand weeding, except when the number of hand weeding were increased from two to three. The beneficial effect of mulching were more pronounced in okra where it gave significantly($p<0.05$) higher amounts of fresh pods (over 3 tons as compared to around 2 tons per hectare) for hand and hoe weeding respectively, though it yielded higher (3.87 tons/ha) compared to 3.82 tons/ha for three hand weeding treatment. The differences were not significant. A cost analysis showed that the use of mulch was financially more rewarding than hand or hoe weeding. The use of 20 tons of dry grass mulch is therefore recommended as a better weed control measure than hand or hoe weeding methods.

KEY WORDS: Comparative, Effectiveness, Cultural Weed Control, Okra Yield, Ultisol

INTRODUCTION

Weeds constitute a lot of nuisance in various human activities, especially in agricultural fields thereby competing with cultivated crop for favourable growth factor like water, nutrients and space that in turn bring about reduction in yield of cultivated crop (Akobundu, 1980).

Generally, crop production in the tropical and sub-tropical regions of Nigeria is being faced with the problem of weeds (IITA, 1980).

Weed control for crop production is necessary and the control methods differ in their effectiveness and profitability. On world-wide basis, weed is the most important agent of crop loss accounting for 15.7 percent in Africa and 6.8 percent in Europe (Cramer, 1977). The importance of weeds is further emphasized by sharing the production costs into that resulting from plant diseases 27%, from insect 28 percent, nematodes 3 percent and from weeds 42 percent (Killigham and Ashton, 1975). The works of Akobundu (1980) reported that in Africa weed control takes more than 50% of the total labour required for producing a crop.

The weed situation is more demanding where rainfall is high. Hill (1977) reported that the high rainfall and humidity in the super humid tropics (humidity over 80 percent) all year round of the River State of Nigeria results in higher weed growth and more crop losses. This high rainfall in the super humid and humid tropics decreases the effectiveness and persistence of herbicides. This was confirmed in the 1980 annual reports by the International Institute of Tropical Agriculture (IITA) who reported that generally all herbicides were more persistent at Ibadan with rainfall of 1,400mm per annum than at Onne less than 20 kilometers from Port-Harcourt with similar annual rainfall of 2,400mm per annum.

Presently, these chemicals are beyond the reach of farmers, when a liter of paracol has escalated from N20 to N110.

Holm (1976) working in the humid and super-humid tropics found some rural communities where the proportion of working time spent on weeding can be as high as 74 percent and losses due to no weeding can be almost total. Lageman, (1977) in his study of traditional farming systems in Eastern Nigeria reported that over 90 percent of the hired labour may be used in weeding during the early rains.

Mulching when well applied was reported to suppress weeds, improve the soil chemical and physical properties and increase crop yield (Lal, 1975, Tumuhairiwe and Gumbs, 1983).

The present study therefore was aimed at investigating the effectiveness of three weed control methods in filed grown okra.

MATERIALS AND METHODS

The field experiment was conducted at the School of Agriculture and Agricultural Technology (SAAT) Teaching and Research farm, Federal University of Technology Owerri, Imo State, Nigeria. The area has annual rainfall ranging from 2000mm to 3000mm. It was conducted in a sandy, loam ultisol in the humid tropics in 2005 and 2006 planting seasons. The area was a secondary bush fallow and dominant weeds prior to ploughing were *Panicum maximum, Ageratum conizoides and Chromolena odorata.*

The okra (*Abelmoschus esculentus*) variety used for this experiment was Lady finger planted 60 x 60 cm spacing, produced by National Horticultural Institute Mbato Okigwe (NIHORT).

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The seed was treated with 10g of *Peperomia pellucida* leaf powder according to Ibe, et. al (1998) to guide against damping-off disease of okra.

A randomized complete block design with four replications was used. Each replicate consist of the four treatment of

(i) Control-(No weeding after plant)
(ii) Mulched with 20 tons/ha of dry *Panicum maximum*, mulch applied 3 weeks from emergence
(iii) Hand weeding (pulling)
(iv) Hoe weeding both at 2 and 5 weeks from emergence.

A one-meter quadrant was used in taking weed samples six weeks after emergence. The weeds collected from this quadrant were oven dried at 65°C for 24-hours and weighed. Three seeds were sown per hole and later thinned down to one.

Plant height was taken from ground to the highest vegetative point up to flowering and only data collected at floweringsix weeks after emergence are presented.

Compound fertilizer was applied at the rate of 60kg active ingredient per hectare after thinning. 34.56kgs of dried *Panicum maximum* mulch was applied to the mulched plots. The yield of fresh pods harvested from the middle two rows was reported in tons per hectare.

Analysis of variance was conducted on data obtained each year and Duncan multiple range test was used in separating the means. A regression analysis was carried out to show the relationship between weediness and crop yield.

RESULTS AND DISCUSSION

In 2005 and 2006 okra plants in all weed controlled plots were significantly taller than the unweeded plots. Among the different weed controlled methods, there were no significant differences as to plant height. However, it should be noted that plants in the mulched plots were taller than those in other weed controlled plots for both 2005 and 2006 (Table 1). Mulch offers tremendous potential for increased crop production through its marked effects on weeds and on the soils physical and chemical environment, which increases crop growth and yield (Tamuhairiwe and Gumbs, 1983).

Table 1: Effect of Different Weed Control Methods on Plant Heights of Okra Taken 6 weeks After Emergence: -

Treatments	**Okra**	
	2005(cm)	**2006(cm)**
No Weeding	0.243[b]	0.241[b]
Hoe Weeding	0.601[a]	0.349[a]
20 Tons/Ha of Dry Mulch	0.602[a]	0.352[a]
Hand Weeding (Pulling)	0.600[a]	0.337[a]

There were no outstanding differences between hoe weeding and hand pulling, though at harvest the hand pulling plots contained more weeds than the hoe weeding plots.

Mulching apart from the above mentioned attributes suppress weed growth and enhance the biological activities in the soil; all these may have contributed to its producing taller plants than both hoe and hand pulling weeding methods.

The dry weed weights were significantly higher in the unweeded plots, (Table 2). In 2005 the okra plots hand weeded and hoe weeding in the second and fifth weeks after crop emergence contained significantly more weeds than the mulched plot.

It is clear therefore that the weed frequency needs to be increased to three and above to equal or better 20 tons dry grass mulch per hectare for okra. Both hand pulling and hoe weeding treatments in both years were not as effective as the mulched plots and contained significantly higher amounts of weeds in the 2005 and 2006 okra plots. With a high rainfall of over 2000mm in the humid tropics, the effectiveness and persistence of the herbicides are drastically reduced (IITA, 1980). In order to reduce the weed yield, heavy mulching or at least three-hand weedings or hoe weeding are recommended in the growth circle of okra.

Table 2: The Influence of Different Weed Control Methods on Dry Weed Weights of Okra Taken 6 weeks After Emergence: -

Treatments	**Okra**	
	2005(cm)	2006(cm)
No Weeding	0.243[b]	0.241[b]
Hoe Weeding	0.601[a]	0.349[a]
20 Tons/Ha of Dry Mulch	0.602[a]	0.352[a]
Hand Weeding (Pulling)	0.600[a]	0.337[a]

The relationship between weed weight and crop yield is shown by the regression line of figure 1 for both 2005 and 2006 respectively: - It confirms clearly that the reduction in crop yield was due to the amount of weed present in plots, increase in weed affected crop yield significantly in 2005 ($r = 0.99$) and 2006 ($r = 0.63$).

The effectiveness of the different weed control methods on yield of okra for both 2005 and 2006 is also presented in (Table 3). Mulched plots gave significantly higher yield than other weed control methods used. The very high okra pod yield of mulching may in addition to its weed suppressing properties be due to other factors like better soil physical and chemical properties. Mulching is therefore, the recommended method of weed control for okra production; however, the weed controlled plots gave significantly higher yields than the unweeded plots (Table 3).

Table 3: Effects of Different Weed Control Methods on the Fresh Pod Yield of Okra: -

Treatments	**Okra**	
	2005	2006
	-Tons/ha-	
No Weeding	1.77[c]	1.15[b]
Hoe Weeding	2.40[b]	1.73[b]
20 Tons/Ha of Dry Mulch	3.05[a]	3.08[a]
Hand Weeding (Pulling)	2.41[b]	1.51[b]

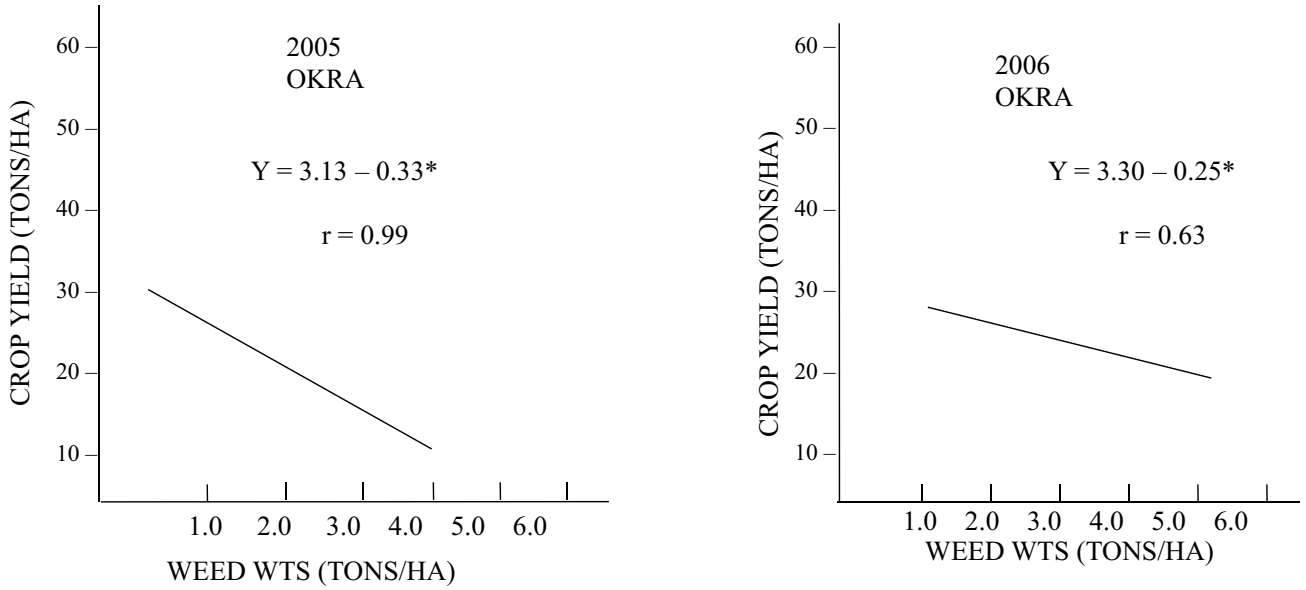

Fig .1 Effects of weeds on crop yield

COST ANALYSIS

The cost analysis of different operations was a major important part of this study. Table 4 gives cost analysis of different operations. Table 5 relates the cost and the yield of the crop and its economic benefits. In 2005, the application of mulch and hoe weeding were more profitable than two hand weedings. Instead of two hand weeding it may be advisable not to weed at all (Table 5). In 2006, mulching gave a higher profit margin than other weed control measures but the differences were not significant. In terms of monetary returns, a profit margin of over one hundred U.S dollars may be enough inducement to adopt mulching over other cultural weed control.

Weed control is a necessary cultural practice for profitable crop husbandary. Considering the different weed control measures evaluated, mulched plots using twenty (20) tons of dry grass was found to significantly produce taller plants, contain lesser weeds and produce significantly higher okra pod yields than other weed control measures. Mulching was more profitable than other weed control methods. (Table 5)

Table 4: Estimated Cost of Carrying out the Different Operations using Estimated Mondays from Philips (1976):

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A.

Mulched Materials (*Chromolaena odorata*)	**No of Mandays**	**Rate per Manday($)**	**Total cost ($)**
Harvesting and Spreading out to dry mulch material	15	6.00	90.00
Transporting to farm and spreading on farm	20	6.00	120.00
Mulched Material/ha	35	6.00	210.00
B.Hand pulling: - In Ultisol, southeastern, Nigeria, use of 20 to 30 mandays			
One hand-pulling	30	6	180.00
Two hand-pulling	60	6	360.00
Three hand-pulling	75	6	450.00
C.Hoe-weeding: - In Ultisol, southeastern, Nigeria use of Two hoe-weeding use 20 to 30 mandays per hectare.			
One hoe-weeding	20	6	120.00
Two hoe-weeding	40	6	240.00
Total cost for hoe-pulling	-	-	360.00

Note: Mandays used in Table 4 are taken from Phillips (1976).

Table 5: Estimate of the Profitability of using Different Weed Control Methods on Okra Plots: -

2005

Treatments	Yield (tons/ha)	Cost of Weed (control/ha)	Output($/ha)	Net Gain
No Weeding	1.75	-	870.00	870.00
3 Hand-pulling	3.83	450.00	1,910.00	1460.00
6 Tons Mulch	3.05	390.00	1,520.00	1,130.00
2 Hoe-Weeding	3.35	250.00	1,675.00	1,425.00

2006

Treatments	Yield (tons/ha)	Cost of Weed (control/ha)	Output($/ha)	Net Gain
No Weeding	2.62	-	870.00	870.00
3 Hand-pulling	3.83	450.00	1,910.00	1460.00
6 Tons Mulch	2.88	390.00	1,935.00	1,545.00
2 Hoe-Weeding	3.36	250.00	1,675.00	1,425.00

The above table assumes all other factors of production to be constant

It will be concluded that mulching cause retention of water which consequently promote yield of crop growing in the environment, and was also suppressed weeds than other weed control methods used. For cost analysis carried out, mulching was an economically viable means of weed control than other weed control methods used in this experiment.

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