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EFFECT OF PARAQUAT AS POST EMERGENCE HERBICIDE ON YIELD OF COWPEA (*Vigna unguiculata* (L) Walp).

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ABSTRACT
The experiment reported herein was undertaken to determine the toxicological effect of paraquat as post emergence herbicide on yield of cowpea. Two rates of paraquat 0.50 kg ai/ha and 1.00kg ai/ha were applied as post emergence herbicide in pot experiment with fallow weed population; which examined the effectiveness for the control of weeds in cowpea. Information was obtained on the weed weight and yield components of cowpea as influenced by the paraquat herbicide. The results showed that there were significant differences (P < 0.05) in yield components of cowpea and weed biomass (weed weight). There was an adequate weed control achieved by paraquat treatments evaluated until 6 weeks after planting (WAP). The unweeded control or treatment had significantly higher (P < 0.05) weed biomass (weed weight) that all other treatments. The cowpea grain from pots that received paraquat at 1.00 kg ai/ha were 2 times more than that from the unweeded control. However, the highest yield of cowpea was obtained from handweeded control pots; the unweeded plots gave the poorest yield. Cowpea yield from paraquat herbicide treatments compared favourably with the yield realized from the handweeded control. Paraquat is therefore, effective for weeds in cowpea without adverse effects at the evaluated rates.

Keywords: Weed Management, Herbicide and Sole cowpea cropping.

INTRODUCTION
Cowpea, *Vigna unguiculata* (L.) Walp is an important legume crop of the tropics. It is a major food crop of millions of people in the developing countries of the world, as it provides cheap and nutritious food for relatively poor Urban communities (Quin, 1997). Cowpea is a cash crop (grain and fodder), by virtue of their high protein content and bringing nitrogen into farming system through nitrogen fixation (Tarawali, *et al*., 2000). Alghali (1991), reported that Nigeria accounts for 70% of world's cowpea production, the bulk of which is grown in the drier regions of Northern Nigeria (IITA, 1998). According to Food and Agricultural Organisation (FAO, 2004), the area under cowpea production in Africa and Nigeria stood at 9.46 million ha and 5.00 million/ha with an annual grain production of 3.73 and 2.20 million tones respectively.

In Nigeria, available data indicate that cowpea production has increased tremendously in the past decade from 1, 751,000 tonnes in 1995 to 2,200, 000 tonnes in 2004 (FMANR, 1997; FAO, 2004), and this attributed to introduction of elite varieties with high yielding potentials by the International Institute for Tropical Agriculture (IITA), Ibadan and Obafemi Awolowo University (OAU), Ile-Ife (Tijani – Eniola 2001). In Africa, yields are estimated at about 250 – 300kg/ha, in Asia and Latin America, about 400 – 500kg/ha and in the USA, about 600 – 800kg/ha (IITA 1989). As noted by Singh and Rachie (1985), potential yields are high (1500 – 4000kg/ha) but average yields are low. Cowpea yield and yield components are influenced by a number of factors which include seed quality, effects of pests and diseases

and competition with weeds for growth factors such as water, valuable nutrients, light and space (Poku and Akobundu, 1985; Akobundu, 1987).

Reports by various workers showed that unchecked weed growth in cowpea reduced the potential yield by 53% (Moody, 1973), 68 - 81% (Akobundu, 1979; 46 - 53% (Fadayomi, 1979); 40 - 60% (Nangju, 1986), 70% (Olunuga, 1981; Ofuya, 1989). Total yield loss may however, result on lands heavily infested by *Alectra vogelli* when susceptible varieties of cowpea are planted (Lagoke, 1989; Alonge *et al*., 2002). The main difficulty in the chemical control of weeds of cowpea is that cowpea varieties differ in a lot of characteristics amongst which is response to herbicide treatment (Akobundu 1987). Increased food production is a high priority in many parts of the world and this need cannot be met without the use of indispensable agricultural inputs, such as pesticides (Dorn 1991). Fadayomi (1991) noted that there was adoption of chemical weed control option to a large extent in Nigeria.

The most widely used herbicide to control weed species in cowpea is Galex. Galex failed to control some weed species in cowpea field which had reduced its value for use in cowpea (Akobundu, 1979; 1982). Fadayomi (1983), found that early post emergence application of paraquat in sugar came farm with other combinations of herbicides gave satisfactory weed control without any crop injury. The critical period of weed competition in cowpea is the first 3 - 4 weeks after planting (WAP) according to Akinyemiju and Echendu (1987), thereby recommending a week - free period for the first 6 WAP. The objective of this experiment was to evaluate the effect of paraquat as post emergence herbicide in cowpea and on yield components of cowpea.

MATERIALS AND METHODS

Pot trial experiment was conducted at the Crop Garden of Department of Crop Protection and Environmental Biology, Faculty of Agriculture and Forestry, University of Ibadan, Ibadan. The experiment was arranged in a Complete Randomised Design (CRD) with six replications. Plastic pots (each was 25cm top diameter) were filled with unsterilized rich garden top soil from the Research Farm, University of Ibadan. The materials used for the experiment were: Ife Brown cowpea variety and paraquat herbicide. Seeds of Ife Brown were obtained from germplasm of Department of crop Protection and Environmental Biology. There were four treatments comprised of paraquat at 0.50 kg ai/ha, 1.00 kg ai/ha, handweeded and unweeded controls or treatments.

The paraquat was applied as post emergence herbicide. Three seeds were planted per pot and the emerged seedlings were later thinned to one stand per pot at 2 weeks after planting (WAP). Manual weeding and herbicides application by using a Veltox pressure hand sprayer of 2.5litre volume were done at 3 and 6 weeks after planting (WAP). Insect pests were controlled as necessary with Cypermethrin at 0.20 kg ai/ha. Weed biomass (weight) harvested from each pot were oven-dried at 70^0C to constant weight. At physiological maturity, yield components which included pod numbers, pod weights, seeds per pod and grain yield were harvested and weighed. Weed control rating was done visually rated on a scale of 0 - 10 where ‘O’ represents no weed control and ‘10’ represents excellent weed control. Data collected were analysed using Analysis of variance (ANOVA) and mean separation was done using Duncan’s Multiple Range test (DMRT) at ($P<0.05$) significance level.

RESULTS AND DISCUSSION

The weed flora separated by morphology at the experimental site is shown in Table 1. About 62.5% of the weed flora was broad leaf weeds. Most of the weeds were annuals while a few were perennials. Annual, perennial grasses and sedges constituted about 37.5% of the weed population (Table 1).

Table 2 shows the effects of weed control effectiveness of paraquat at 3 and 6 weeks after planting (WAP). Weed control rating showed significant differences ($P<0.05$) amongst the treatments (Table 2). In Table 2, the weed control rating at 3 and 6 WAP was higher in handweeded treatment with significant difference ($P<0.05$) from herbicide treatments. There was also a significant difference ($P<0.05$) between paraquat at the rate of 0.50kg ai/ha and 1.00kg ai/ha in weed control. However, there was no significant ($P<0.05$) effect between the rates of paraquat at 0.50 kg ai/ha and 1.00kg ai/ha on weed biomass (weed weight) but showed a significant difference ($P<0.05$) from hand weeded treatment or control. The weed control rating and weed biomass of the unweeded treatment or control recorded the highest which was highly significantly different ($P<0.05$) from the various rates of paraquat herbicide and the hand weed treatment.

Table 3 shows the toxicological effect of paraquat as post emergence herbicide on yield components of cowpea. There was no significant effect ($P<0.05$) between paraquat at 0.50kg ai/ha and unweeded treatment. In all the yield components, there were significantly higher yield components from herbicide treatments and handweeded while poor yield components were recorded from unweeded treatment. Grain yield of herbicide treatments and handweeded were significantly ($P<0.05$) higher than the yield obtained in unweeded treatment. Also, there was no significant difference ($P<0.05$) between herbicide treatments and handweeded in cowpea grain yield. The findings of this study show that, the efficiency of chemical weed control (paraquat) is for increasing crop yield and reducing the labour cost in the tropics especially in Nigeria. This assertion is supported by earlier findings by Akobundu, 1987; Lagoke *et al* 1981; Ogungbile and Lagoke 1986; and Lagoke *et al* 1987; 1988. Weed control in all the treated pots was good and adequate to 6 WAP. Paraquat at the two rates 0.50 and 1.00 kg ai/ha achieved moderately high control of weeds throughout the trial. The lower rate of paraquat at 0.50 kg ai/ha controlled weeds better than unweeded treatment.

The results of this present study also show that there was a reduction in all the yield components in unweeded treatment which may be attributed to high number of weeds present which may lead to serve competition between cowpea and the weeds. This is supported by the report of Carbon (1979) and Ishag (1971) that yield components affected by weed competition are pod number, seeds per pod and weight of the seeds (yield). The reduction in pod number by weed interference is directly related to the adverse effect of uncontrolled weed growth on branching in grain legumes. Yield components; number of pods and grain weight were highest in treatments that received handweeding. This is in agreement with the work of Olofintoye and Adesiyun (1989) that the highest grain yield was obtained in hand weeded and the least in unweeded.

All the yield components obtained under herbicide treatments and handweeded confirm the recommendation that a free period for the first 6 WAP be maintained, (Akobundu, 1985) and that weed control and hand weeding at 3rd and 5th WAP is enough for cowpea (Akobundu, 1987; Akinyemiju and Olaifa, 1991). According to Fadayomi 1979), up to 4 weeks of weed competition did not reduce yield, if the plots were maintained weed free thereafter.

CONCLUSION AND RECOMMENDATION

Results from the trial indicated that paraquat at 1.00kg ai/ha gave good weed control up till 6 WAP and similar to the handweeded control. It was found that the yield from pots that received paraquat at 1.00kg ai/ha were among the best with high cowpea yield. It is recommended that paraquat herbicide at the rate of 1.00 kg ai/ha should be used in cowpea production so as to bring high yield of cowpea grain.

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Table 1: **Weed species in the experimental pots**

Weed species	Form	Life-cycle
Aspillia africana (Pers.) C. D. Adams	Broadleaf	Annual
Agerantum conyzoides L.	Broadleaf	Annual
Euphorbia heterophylla .L.	Broadleaf	Annual
Talinium frutiscorp (Jacq.) Willd	Broadleaf	Annual
Tridax procumbens .L.	Broadleaf	Annual
Panicum maximum Jacq.	Grass	Perennial
Eleusine indica Gaerth	Grass	Perennial
Cyperus rotundus .L.	Sedge	Perennial

Table 2: The Effect of Paraquat as Post Emergence Herbicide on Weed Control Rating and Weed Biomass (weight) at 3 and 6 Weeks After Planting in cowpea.

Treaments application	Rate of Rating kg ai/ha	Weed Control		Weed Biomass Weight g/pot	
		3 WAP	6WAP	3 WAP	6 WAP
Paraquat	1.00	6.00[b]	6.00[b]	9.11[b]	5.00[b]
Paraquat	0.50	4.50[c]	4.50[c]	10.20[b]	6.10[b]
Handweeded	-	10.00[a]	10.00[a]	1.00[c]	0.00[c]
Unweeded	-	0.00[d]	0.00[d]	18.50[a]	21.45[a]
Treatment Mean		5.13	5.13	9.70	8.14
S.E $\pm$		1.19	1.19	2.07	2.67

WAP = Weeks After Planting

Means followed by the same letter within a column are not significantly different at $P<0.05$ level of probability using DMRT.

Weed Control is rated on a scale of 0-10 where ‘O’ means no weed controlled and “10” means excellent weed control.

Table 3:The Effect of Paraquat as Post Emergence Herbicide on yield components of cowpea.

Treatments	Rate of Application kg ai/ha	Number of pods pot	Pod weight g/pod / pot	Number of seeds/ pod	Grain yield g / pot
Paraquat	1.00	10.67[ab]	12.77[a]	6.83[ab]	10.60[ab]
Paraquat	0.50	14.33[a]	11.96[ab]	5.00[c]	9.60[ab]
Handweeded	-	16.16[a]	14.45[a]	7.00[a]	11.85[a]
Unweeded	-	4.00[b]	8.00[b]	4.30[c]	7.41[b]
Treatment Mean		11.29	11.80	5.78	9.87
S.E $\pm$		1.55	0.79	0.39	0.54

Means followed by the same letter within a column are not significantly different at $P<0.05$ level of probability using DMRT.