

Evaluation of Herbicides on Weed Control, Performance and Profitability of Onion (*Allium cepa*) in the Forest Zone of Nigeria

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Abstract: Field experiments were conducted in 2009 and 2010 dry season to evaluate the performance of herbicides on onion varieties. The results revealed that all the weed control methods significantly ($P<0.05$) decreased weed population. Similarly, survival percentage of onion was affected by the use of chemical. Bulb diameter, number of bulbs and onion yield were affected by the application of chemicals. The lowest yield in the control was due to the competition of weeds with the onion plants for space, nutrients and light as is evident from the high population of weeds in this treatment. The use of oxyflorfen reduced weeds competition which resulted in greater number of bulbs plot⁻¹, highest survival percentage and highest bulb diameter. It also increases gross margin. The use of oxyflorfen gave the best performance in all the parameters measured. It can be concluded that the profitability of producing onion is higher in the Guinea savannah than in the Forest zone and the profitability in the Forest zone can be increased by the use of selective herbicides (Oxyflorfen) at the recommended rate.

Key words: Weed control • Onion Production • Onion Varieties • Herbicides

INTRODUCTION

Onion *Allium cepa*, belonging to the family *Amaryllidaceae* is one of the most important vegetable crops all over the world. Onion is a condiment crop and consumed as a fresh in salad pickles or added in cooking dishes as a spice. Apart from furnishing nutrition, it provide relishing flavor to our diet. It also used to cure a wide array of physiological disorder such as Cough, Obesity, Insomnia, hemorrhoid and Constipation [1]. Weed control is an unavoidable need for successful production of vegetable crops like onion. Product losses increase with weed infestation [2]. Controlling weed development during the Onion crop cycle is essential to obtain high yields and marketable product. Onions do not compete well with weeds: they are slow growing and can suffer from successive flushes of weed. They have narrow upright leaves which do not shade out weeds that emerge in the row. So early season weed control is critical for successful onion production [3].

The broad leaf herbicides available for post emergent use in onion is only marginally selective and are most effective if applied when weeds are small [4]. Crop injury

is also more likely when these herbicides are applied to very small onion. Onion producers are faced with troubling question: Should they apply herbicide early to slow the weed and risk crop injury from the herbicide or would it be better to wait for the onion to get big enough to safely spray and risk crop loss from early weed competition or weeds getting too large to control [5].

It has been shown that farmers are using various ways to control weed, however, their dependence is mainly hoe weeding. Despite high yielding cultivars, adequate seedling per unit area, adequate irrigation and other cultural practices, yield is very low due to weed infestation [6]. Losses from 45% to 56% have been reported from India due to weed interference [7]. Losses up to 96% in onion due to weed competition have been reported from United Kingdom [2]. The critical weed competition is up to 40 days after transplanting [8]. In weedy control yield was decreased by 54% compared to weedy free condition. Uncontrolled weed growth caused 49-86% reduction in the bulb yield compared with best herbicide treatment [9]. [10] reported that in the Northern Guinea Savannah of Nigeria the application of oxyflorfen reduced labour requirements by 75%.

Table 1: Yield of Onion varieties as affected by post -emergence herbicides in Northern Guinea Savannah of Nigeria

Weed control methods	2009		2010		Mean		Gross margin
	Redcreole	Early Texas yellow	Redcreole	Early Texas yellow	Redcreole	Early Texas yellow	
3 hand weeding	24.00 ^a	23.76 ^a	23.36	20.39 ^a	23.68 ^a	22.08 ^a	4,485,250
S matolachlor	12.90 ^b	12.75 ^b	11.94 ^b	12.30 ^b	12.83 ^b	12.53 ^b	2,343,500
pendimenthaline	10.10 ^b	10.28 ^b	10.58 ^b	10.30 ^b	10.19 ^b	10.29 ^b	1,817,425
Oxyflorfen	24.05 ^a	22.83 ^a	24.43 ^a	22.34 ^a	24.24 ^a	22.59 ^a	4,623,200
Un weeded Control	5.77 ^c	5.730 ^c	5.64 ^c	5.74 ^c	5.75 ^c	5.74 ^c	941,050
C.V	13	13	12	11	12	13	

Source. [10]

The yield and economic performance of onion was impressive when it was applied as post emergent at 4 weeks after transplanting. Profitability of onion was increased by 3% over 3 hand weeding and that yield loss was as high as 80% in an uncontrolled condition as shown in the table 1.

In Nigeria, Onion is produce majorly in the Guinea Savannah and from 1995 till date there has been a decline in the production of onion in onion producing area in terms of area and output /ha. Onion has become more expensive particularly in the forest where it is largely consumed. The cost of transportation and the bad road from the North to southern Nigeria is of major concern and these factors make Onion very expensive. There is a need to evaluate Onion productivity in the forest zone of Nigeria under weed control strategies. Onions do not compete well with weeds; hence weed control is essential for a successful onion production. There is no any information on weed control in onion production in this part of Nigeria. The objective of this work is to evaluate available early post emergent herbicides on weed control and on the performance of onion and also look at the profitability of producing onion in the study area and compared it with what is obtainable in the Northern Guinea Savannah.

MATERIALS AND METHODS

Field experiments were carried out at Akufo farm settlement in Ibadan Oyo State 7°23'16"N 3°53'47"E 275m above sea level during the dry seasons of 2009 and 2010. Seeds were planted at 15cm interval in a 120cm wide seed bed using a groove of about 12mm depth along the rows 60grms of seeds per Ha was used. The seedlings were transplanted 8 weeks after sowing in the nursery. It was fertilized using 100kg of NPK at five weeks after transplanting and was irrigated weekly up to 13 weeks

after transplanting. The bulbs were harvested at 15 weeks after transplanting. The treatments were laid out in a randomized complete block design replicated 3 times. The treatment consisted of factorial combination of 2 varieties of onions (Redcreole and Early Texas yellow) and five weed control methods (Three hand weeding, S-metolachlor 960 EC @ 2.5 liter ha⁻¹, pendimenthaline 33% (w/v) EC @ 3.25 liter ha⁻¹, Oxyflorfen 240g/ltr E.C at 350 ml ha⁻¹ and unweeded check). Herbicides were applied at 2 weeks after transplanting with knapsack sprayer in a spray volume of about 200 liter per ha. Unsprayed plots were hand weeded at 4, 8 and 12 weeks after sowing. Data were collected on weed density, onion survival percentages, the diameter of Onion, number of bulb of Onion and yield of Onion. Data collected were subjected to analysis of variance, where significant differences existed, the Duncan multiple range test was applied. All statistical procedures were done as described by Gomez and Gomez (1984). To examine the profitability of the different weed control methods the gross margin analysis was done. The cost of the inputs and price of the products were obtained from market survey. The variable cost were those of labor, chemicals, harvest and post harvest handling and the revenue was the farm gate price of onion at 350/kg.. (During the study US\$=152 Naira

RESULTS

The major weeds in the study area includes grasses such as *Cynodon dactylon* (L) pers, *Digitaria ciliaris* willd, *Elusine indica* Garten and *Dactyloctenium* (L) Beave. Broad leaves such as *Solanum nigrum* L., *S. americanum* Mill., *Ageratum conyzoids* L., *Amaratum spinosus* L. and *Acanthospermum hispidum* DC. Sedges are few and include *Sida cuta* and *Cyprus* spp. The conventional hoe weeding has the lowest weed dry matter, weed cover score and highest survival percentage.

Table 2: Effect of different weed control measure on weed control in onion in the forest agro ecological zone of Nigeria in 2009-2010 dry seasons

Weed control methods	2009	2010	2009	2010	2009	2010
	Weed dry mm	Weed dry mater	Weed cover score (%)	Weed cover score (%)	Survival percentage of onion	Survival percentage onion
Hoe weeding	3.0 ^d	2.33 ^d	5.59 ^d	6.92 ^d	91.10 ^a	91.20 ^a
S matolachlor	25.67 ^b	17.00 ^b	40.79 ^b	59.24 ^b	65.70 ^c	71.90 ^c
Pendimethaline	21.33 ^b	22.3 ^b	53.51 ^b	49.22 ^b	88.40 ^b	85.77 ^b
Oxyflourfen	7.89 ^c	6.57 ^c	15.76 ^c	18.20 ^c	93.00 ^a	92.00 ^a
Un weeded check	43.33 ^a	41.67 ^a	100 ^a	100 ^a	87.90 ^b	81.33 ^b
C.V (%)	36.02	33.6	19.89	20.02	19.57	13.83
Variety						
Redcreol	14.0	9.2	5.95	7.28	91.2	92.0
Early Texas yellow	12.0	8.0	7.28	8.61	92.3	91.5
C.V (%)	14.28	13.04	18.29	15.46	11.19	10.54
Interaction						
WCX V	NS	NS	NS	NS	NS	NS

Means within a column of treatments followed by unlike letter(s) are significantly different using DMRT at 5% level of significance.

WCxV – Interaction between weed control methods and varieties

NS – Not Significant

Table 3: Effect of different weed control measure on yield parameters of onion in the forest agro ecological zone of Nigeria in 2009-2010 dry seasons

Weed control methods	2009	2010	2009	2010	2009	2010	2009-2010
	Number of bulbs	Number of bulbs	Bulb diameter	Bulb diameter	Yield of Bulb (tonnes/ha)	Yield of Bulb (tonnes/ha)	Mean yield of onion bulb
Hoe weeding	69.90a	70.60 a	5.86b	6.06b	15.60b	10.07a	11.74b
S matolachlor	67.00a	65.00 a	5.73b	5.30c	10.30c	7.73b	9.01c
Pendimethaline	68.67a	68.00 a	5.90b	6.00b	10.30c	7.72b	9.01c
Oxyflourfen	69.80a	71.00 a	6.40a	6.67a	18.58a	11.2a	13.65a
Un weeded check	59.00b	65.00b	2.90d	2.67d	3.67c	2.75c	3.21d
C.V (%)	28.29	20.55	42.41	32.11	18.75	15.54	17.15
Variety							
Redcreol	68.3	70	6.67	6.54	15.5	9.59	12.55
Early Texas yellow	67.7	68.53	6.5	6.45	15.34	10	12.67
C.V. (%)	32.983	32.17	12.54	12.65	17.98	16.23	17.12
Interaction							
WCX V	NS	NS	NS	NS	NS	NS	NS

Means within a column of treatments followed by unlike letter(s) are significantly different using DMRT at 5% level of significance.

WCxV – Interaction between weed control methods and varieties

NS – Not Significant

Table 4: Costs and returns per Ha. For Onion production under different weed control methods

Weed control methods (Inputs)	Cost of weeding	Harvest and post harvest cost	Cost of chemicals and its application	Other cost Naira	Total Variable cost	Revenue (Yield x price)	Gross Margin Naira
S- Metolachlor	-	17,000	11,250	194,250	222,500	2703000	2,480,500
Pendimethaline	-	16,450	9,875	194,250	220,575	2703000	2,482,425
Oxyflorfen	-	20,300	10,250	194,250	224,800	4080000	3,855,200
3Hoe weeding	36,000	20,500	-	194,250	250,750	3522000	3,271,250
Unweeded Control	-	14,700	-	194,250	208,950	963000	754,050
Redcreole	-	20,300	10,250	194,250	224,800	3765000	3,540,200
Early Texas yellow	-	20,300	10,250	194,250	224,800	3801000	3,576,200

Among the herbicides used oxyflorfen performed better than the other chemical but its performance was lower as compared to hoe weeding. The unweeded plot has the highest weed dry matter, weed cover but relatively high survival percentage. There was no significant difference among the two varieties tested and there was no significant interaction between weed control methods and varieties as shown in table 2.

The unweeded plots produced the lowest numbers of bulb, lowest bulb diameter and onion yield. The use of oxyflorfen gave the highest numbers of bulb, bulb diameter and onion yield and was significantly better than hoe weeding. There was similarity on bulb diameter between hoe weeding and the use of other herbicides. The mean yield produced by the use of oxyflorfen was significantly higher than hoe weeding. Hoe weeding however was also significantly higher than other herbicides. As shown in table 3 above. The highest gross margin was obtained by the use of oxyflorfen closely followed by hoe weeding. The use of S- Metolachlor and Pendimethaline gave almost the same margin. The unweeded plots gave the lowest gross margin. The early Texas yellow variety was N36, 000 more profit table than the redcreole variety. As shown in table 4.

DISCUSSION

The results revealed that all the weed control methods significantly ($P < 0.05$) decreased weed population, which is similar to the work of 9 and 10. Similarly, survival percentage of onion was affected by the use of chemical. Bulb diameter, number of bulbs and onion yield were affected by the application of chemicals. These findings confirm the results reported by [4,2].

The lowest yield in the control was due to the competition of weeds with the onion plants for space, nutrients and light as is evident from the high population of weeds in this treatment. Three times hoe weeding reduced weeds competition which resulted in greater number of bulbs plot⁻¹, highest survival percentage and highest bulb diameter. The use of oxyflourfen gave the best performance in all the parameters measured. Therefore, the use of oxyflourfen is recommended as the best herbicides for the control of weed in onion. The amount of labor required for hoe weeding was high. The cost was also higher and to reduce crop injury it need to be carefully weeded. Since labour as been identified as one of the limiting factors for production in Nigeria the use of herbicides will greatly facilitate production. The

use of herbicides reduced labour requirements by four times [10]. Both Yield and other factors such as availability of labour and economic feasibility are very important in considering weed control strategies, 11 have recommended herbicides for use in ginger production in replacement of hand weeding especially where labour is scarce and expensive and production is carried out in large scale. The effect of these herbicides on crop is also very important thus the use of S- Metolachlor and Pendimethaline not suitable as post emergence because of crop injury.

The price of onion was N200/kg in the savannah and N300/kg in the forest zone at the time of harvest. Using these prices It was more profitable producing onion in the Guinea Savannah as compared to Forest zone by N1, 214,000 by using the conventional hoe weeding. Application of oxyflorfen increased the profitability of onion production in the forest giving a difference of N76, 800. The unweeded plots in the forest zone resulted in lower profit N754, 050 as compared to the Guinea Savannah N941, 050. This shows that there are more weed problems in the forest zone.

CONCLUSIONS

It can be concluded that the profitability of producing onion is higher in the guinea savannah than the forest zone and the profitability in the forest zone can be increased by the use of selective herbicides (Oxyflorfen) at the recommended rate of 350ml per Ha.

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