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Effect of Herbicide Seed Treatment on the Reaction of Groundnut (*Arachis hypogaea* L.) To *Alectra vogelii* (Benth)

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Abstract: A field study was conducted in 1999 and 2000 wet season at Samaru (11°11' N; 07° 38' E) in the northern Guinea Savanna of Nigeria; to assess the efficacy of seed treatment with herbicides for the control of Alectra vogelii in groundnut .In the investigation, three groundnut genotypes (SAMNUT - 11, SAMNUT - 16, SAMNUT - 18) were evaluated using three rates of imazaquin (0.27, 0.54, 0.81 g a.i.l^{-1} of water); three cinosulfuran rates (0.02, 0.04, 0.08 g a.i.l^{-1} of water) and two checks (water soaked and un-soaked).The obtained results showed that in spite of hosting high Alectra infestation, imazaquin at 0.27 g a.i.l^{-1} of water produced a significantly higher pod and kernel yields than all other treatments in 1999. Although cinosulfuran at all rates reduced Alectra numbers, compared to the checks, it decreased crop vigour, pod and kernel yields.

Key words: Seed treatment · *Alectra* · Imazaquin · Cinosulfuran

INTRODUCTION

The negative effect of weed in reducing the vegetative and yield performance of crops has to do with their competition with crops for growth factors. The effect is more pronounced where it involves high population of parasitic weeds, because the parasites withdraw nutrients and water from the host plant. Hence, not only is the crop deprived of nutrients, but it also makes the energy utilized for their up take a waste. *Alectra vogelii* is one of the parasitic weeds that pose serious threat to the production of legumes such as groundnut and cowpea in the Nigerian Savanna [1]. Investigation has shown that *Alectra* infection reduced shoot dry matter and grain yield in cowpea [2].

Groundnut is an important crop to many farmers in the Nigerian Savanna. Apart from providing revenue to the farmers, it also avails them with cheap source of protein for their local consumption. In addition, it provides raw materials to various industries and feeds for livestock. However, the menace of *Alectra* invasion on the crop is on the increase in the region, common control method used by farmers in the area is hand weeding; this has not been effective in that it encourages the emergence of more *Alectra* shoots. Therefore there is the need to source for effective control methods to combat the devastating effect of this parasite on groundnut. Use of 0.35 percent of the herbicide imazaquin as seed treatment has been reported to reduce the virulence of *Alectra* on cowpea [3]. Similarly soaking cowpea in 18 percent imazaquin and 10 percent imazathpyr has been observed to reduce *Alectra* shoot emergence [4], Also treatment of cowpea seeds with 20 percent cinosulfuran has been found to suppress *Alectra* shoot emergence in the crop [5]. Therefore, this study was undertaken with the aim of assessing the use of herbicide as seed treatment for the control of *Alectra vogelii* in groundnut.

MATHRIALS AND METHODS

A field trial was conducted in 1999 and 2000 raining seasons to assess the use of herbicide as seed treatment for the control of *Alectra vogelii* in groundnut. In both years the trial was undertaken at the Institute of Agricultural Research (IAR) farm, Samaru (11° 11' N; 07°38' E) in the northern Guinea Savanna ecology of Nigeria; where alfisol is the dominant soil type. The trial was laid out in split -plot design with three groundnut

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varieties (SAMNUTS-11, 16, 18) in the main plots; while the sub-treatments consisted of seed treatment using imazaquin at three rates (0.27, 0.54, 0.81g a.i.l^{-1} of water), cinosulfuran at three rates (0.02, 0.04, 0.08g a.i.l^{-1} of water), two checks (water- soaked and un-soaked). Each solution was prepared by measuring the respective quantity of the herbicides scepter (18%) and set-off (20WG) that gave the corresponding dosages of imazaquin and cinosulfuran into one litre of water and stirred thoroughly. The groundnut seeds were soaked for three minutes before decanting to remove the seeds. Immediately after that, the seeds were sown.

Although the study was conducted in a field that was already infested with *Alectra,* the field was artificially inoculated with *Alectra* seeds every season so as to add to the *Alectra* seed pool in the soil. The *Alectra* inoculums stock was prepared each year by thoroughly mixing 2g of *Alectra* seeds with 0.88kg of sand. It was from this stock that 5g was taken to inoculate each planting hill just before sowing. The trial was sowed on July 7 and June 15 in 1999 and 2000, respectively. Two seeds were sown per hill at the spacing of 75cm by 25cm. Phosphorus was applied at the rate of 22.0kg P/ha at 2 WAS(weeks after sowing). The field was hand weeded at 2,4 and 9 WAS. The weeds were hand pulled during the last two weeding to avoid destroying the un-emerged and emerged *Alectra* shoots. Counting of the emerged shoots was carried out weekly from the time the first emerged *Alectra* shoot was observed in the trial. Crop vigour was scored on the scale of 1 - 5; 1 = very poor vegetative plant performance, 5 = very vigorous plant with flourishing green foliage. Data were collected, analyzed and ranked using Duncan multiple Range test [6].

RESULTS

The genotypes hosted similar number of *Alectra* shoots at all growth stages in the two years; except in the combined analysis at 15 WAS when SAMNUT -16 supported higher *Alectra* shoot population than SAMNUT - 18 only (Table 1). All rates of imazaquin and the two checks had comparable *Alectra* number at all growth stages in both years and the combined data; except that in the year 2000 at 9 WAS imazaquin

Table 1: Influence of genotype, imazaquin and cinosulfuron herbicide seed treatment on the number of *Alectra* shoots in groundnut grown under *Alectra* infestation at samaru in 1999 and 2000 rainy seasons

	Number of *Alectra* shoots/4.5 m^2 at								
	9 WAS			12 WAS			15 WAS		
Treatment	1999	2000	Combined	1999	2000	Combined	1999	2000	Combined
Genotype									
SAMNUT-11	1.0	0.7	0.8	4.0	2.2	3.1	5.4	5.9	5.7ab
SAMNUT-16	1.0	1.2	1.1	4.5	4.1	4.3	5.6	9.9	7.7a
SAMNUT-18	2.0	2.3	2.1	4.0	2.0	3.0	2.1	2.2	2.1b
SE ±	0.53	0.47	0.35	1.22	1.23	0.86	0.90	2.15	1.17
	ns	ns	ns	ns	ns	ns	ns	ns	ns
Seed Treatment Imazaquin (g/l of water)									
0.27	2.1	3.7a	2.9a	8.1a	4.8a	6.4a	6.9a	6.3abc	6.6a
0.54	1.7	1.6bc	1.6a	5.8a	3.7ab	4.7a	6.8a	7.6ab	7.2a
0.81	2.3	1.7abc	2.0a	7.4a	3.6ab	5.5a	6.4a	10.6a	8.5a
Cinosulfuron (g/l of water)									
0.02	0.0	0.1c	0.1b	0.6b	0.4bc	0.5b	1.7b	2.0bc	1.8b
0.04	0.0	0.0c	0.1b	0.0b	0.0c	0.0b	1.2b	0.1c	0.7b
0.08	0.0	0.0c	0.0b	0.0b	0.0c	0.0b	1.1b	0.0c	0.1b
Water soaked (check)	2.3	1.4bc	1.9a	4.7a	5.0a	4.8a	6.4a	10.0a	8.2a
Un-soaked (check)	2.2	2.7ab	2.4a	6.9a	4.7a	5.7a	5.4a	11.3a	8.4a
SE ±	0.74	0.67	0.50	1.4	1.1	0.88	1.3	2.08	1.22
	ns								

Means followed by common letter(s) in each treatment group are not significantly, different at 5% level of probability using Duncan multiple Range Test
WAS = Weeks after saving ns= Not significant at 5% level of probability

Table 2: Effect of genotype, imazaquin and cinosulfuron herbicide seed treatment on the crop vigour score of groundnut grown under *Alectra* infestation at samaru in 1999 and 2000 rainy seasons

	Crop vigour score at					
	9 WAS			12 WAS		
Treatment	1999	2000	Combined	1999	2000	Combined
Genotype						
SAMNUT-11	3.7	4.0ab	3.8b	3.8b	4.0b	3.9b
SAMNUT-16	3.7	3.7b	3.7b	3.5b	4.0b	3.8b
SAMNUT-18	4.1	4.2a	4.2a	4.3a	4.3a	4.3a
SE ±	0.19	0.10	0.11	0.12	0.05	0.06
	ns					
Seed Treatment Imazaquin (g/l of water)						
0.27	4.9a	4.9a	4.9a	5.0a	4.9a	4.9a
0.54	4.8a	4.9a	4.8a	4.8ab	5.0a	409a
0.81	4.4b	4.9a	4.7a	4.4b	5.0a	4.7a
Cinosulfuron (g/l of water)						
0.02	2.3c	3.1b	2.7b	2.4c	3.4b	2.9a
0.04	2.1cd	2.2c	2.2c	2.1cd	2.4c	2.3c
0.08	2.0d	2.2c	2.1c	1.7d	2.1d	1.9d
Water soaked (check)	4.9a	4.8a	4.8a	4.9ab	5.0a	4.9a
Unsoaked (check)	4.9a	4.7a	4.8a	4.9ab	5.0a	4.9a
SE ±	0.11	0.13	0.13	0.15	0.07	0.08

Means followed by common letter(s) in each treatment group are not significantly, different at 5% level of probability using Duncan multiple Range Test
ns= Not significant at 5% level of probability
WAS = Weeks after sowing Vigour score (1 -5)
1= very poor plant performance vegetatively
5 = very vigorous plant with flourishing green foliage

Table 3: Influence of genotype, imazaquin and cinosulfuron herbicide seed treatment on shelling percentage pod and kernel yields of groundnut grown under *Alectra* infestation at samaru in 1999 and 2000 rainy seasons

	Pod yield (kg/ha)			Shelling percentage (%)			Kernel yield (kg/ha)		
Treatment	1999	2000	Combined	1999	2000	Combined	1999	2000	Combined
Genotype									
SAMNUT-11	999a	1520a	1259a	56.5	62.1	59.3	634a	1018a	821a
SAMNUT-16	926a	1365ab	1145b	59.3	62.5	61.0	589a	908ab	749a
SAMNUT-18	516b	964b	740c	59.9	58.0	58.9	350b	555b	457b
SE ±	77.7	114.3	37.0	2.12	2.50	2.64	49.2	76.4	130.2
				ns	ns	ns			
Seed Treatment Imazaquin (g/l of water)									
0.27	1557a	1840a	1698a	63.2a	65.7a	64.4a	997a	1210a	1104a
0.54	1209bc	1872a	1540ab	62.5a	62.5a	62.5ab	768b	1183a	976ab
0.81	1058c	1892a	1475b	61.9a	60.9a	61.4ab	662b	1195a	929ab
Cinosulfuron (g/l of water)									
0.02	89d	379b	234c	55.4b	60.5a	57.9ab	51c	230b	141c
0.04	32d	101c	66c	53.0b	60.7a	56.8b	18c	61b	39c
0.08	8d	40c	24d	42.k	47.4b	45.4c	6c	24b	16c
Water soaked (check)	1269bc	1879a	1574ab	61.3a	63.2a	62.2ab	805b	1227a	1016ab
Unsoaked (check)	1287b	2096a	1691a	61.5a	64.7a	63.1ab	811b	1375a	1093a
SE ±	71.6	97.5	60.4	1.77	3.57	2.02	50.3	69.8	135.5

Means followed by common letter(s) in each treatment group are not significantly, different at 5% level of probability using Duncan multiple Range Test
ns = Not significant at 5% level of probability

at 0.54 g rate and the water soaked check reduced *Alectra* shoot number appreciably below that of 0.27 g imazaquin dose. Also varying cinosulfuron rate had no marked effect on *Alectra* shoot population in the study. However at 12 and 15 WAS in the two years and all combined data all cinosulfuron doses had considerably fewer *Alectra* shoot number than the two checks and supported significantly lower *Alectra* shoot population than all rates of imazaquin in 1999 and the combined data.

With respect to crop vigour, except in 1999, SAMNUT-18 exhibited plants of higher vigour than SAMNUTS - 11 and 16 which were at par (Table 2). All rates of imazaquin and the two checks produced plants of similar vigour except in 1999 when the 0.81g rate had plants of lower vigour than others at 9 WAS and poorer vigour than the 0.27g dose at 12 WAS. Among the cinosulfuron rates only the 0.02g dose consistently exhibited plants of higher vigour than the highest dose of 0.08g. Furthermore, all imazaquin rates and the checks produced more vigorous plants than cinosulfuron treatments at all stages in the two years and the combined data. In the two years SAMNUT-11 and SAMNUT-16 recorded similar pod yield, while SAMNUT-18 had lower pod yield than both genotypes and SAMNUT-11 in 1999 and 2000, respectively (Table 3). However, in the combined data SAMNUT-11 had significantly higher pod yield than SAMNUT -16 which in turn out - yielded SAMNUT-18. In both years and the combined data all rates of imazaquin and the checks had superior pod yield compared with all rates of cinosulfuron. Imazaquin at 0.27 g rate out - yielded all other seed treatments in 1999; while in 2000 and the combined data all rates of imazaquin and the checks had similar pod yield. However, imazaquin at 0.27 g l^{-1} and the un-soaked check produced significantly higher pod yield than the 0.8lg imazaquin dose in the combined data. Rate of cinosulfuron did not affect pod yield in 1999, but in 2000 the 0.02g rate out-yielded the 0.04 and 0.08 g doses; while only 0.08 g rate had inferior pod yield in the combined data.

Genotype had no significant effect on shelling percentage in the study (Table 3). All imazaquin rates and both checks had similar shelling percentages; which were higher than all cinosulfuron rates in 1999. In the combined data only 0.27g imazaquin dose which recorded the highest value exhibited significantly higher shelling percentage than 0.04 and 0.08g rates of cinosulfuron which had the lowest values. In both years and the combined data SAMNUT-11 and SAMNUT-16 gave comparable kernel yield which were superior to that of SAMNUT-18 in 1999 and the combined data (Table 3). In 2000 SAMNUT - 11 out- yielded SAMNUT-18. All rates of imazaquin and the checks recorded significantly higher kernel yields than any of the rates of cinosulfuron. In 1999, imazaquin at 0.27g gl^{-1} gave a considerably higher kernel yield than any other seed treatment. However, in 2000 all doses of imazaquin and the checks had comparably kernel yields. Similar trend was observed in the combined data, except that imazaquin at 0.81g rate depressed kernel yield considerably below that of 0.27g dose and the un-soaked check. Furthermore, all the rates of cinosulfuron in both years gave kernel yields that were at par.

DISCUSSION

There is generally no variation in the *Alectra* shoot population by the genotypes except in the combined data at 15 WAS. The highest susceptibility to *Alectra* infestation exhibited by SAMNUT-16 than SAMNUT-18 at this stage might be due to greater production of germination stimulant at later growth stage in SAMNUT-16 than the latter. It could also imply that the susceptibility of different genotypes to *Alectra* parasitism could vary with stage of growth. The superiority in yield shown by SAMNUTS- 11 and 16 over SAMNUT-18 in spite of greater vigour displayed by SAMNUT-18 could be attributed to the greater yield potential of the other two varieties [7].

Treating groundnut seeds with imazaquin had no significant effect on *Alectra* shoot number irrespective of the rates. This contrasts with the findings in a field study in the northern Guinea savanna of Nigeria; where soaking cowpea seed in 0.54 and 0.81g a.i.l^{-1} of imazaquin reduced *Alectra* shoot emergence [8]. Also Berner, *et al.* [3] reported that soaking cowpea in 1.8-27mg a.i.l^{-1} imazaquin significantly reduced emerged *Alectra* and *striga* shoots in a screen house work. However, they reported yield depression in cowpea as a result of the seed treatment. In contrast, the present study showed that imazaquin at 0.27g a.i.g a.i.l^{-1} gave significantly higher pod and kernel yields in 1999 compared with all other treatment. It also produced the highest mean pod and kernel yields but was at par with 0.54g a.i.l^{-1} imazaquin dose and the two checks. It is possible that groundnut is more tolerant to the herbicide as seed treatment than cowpea. Since the herbicide did not reduce *Alectra* shoot population in groundnut, it probably conferred *Alectra* tolerance to parasitism in groundnut; which enabled it to achieve this good yield performance. Although cinosulfuron at all rates reduced *Alectra* shoot population, all the rates also decreased crop vigour, pod and kernel yields. The suppressive effect of cinosulfuron on *Alectra* parasitism agrees with the report of Shinggu [5] on cowpea, but it conflicts with her findings of increased cowpea grain yield when cowpea was treated with 0.08g a.i.l^{-1} cinosulfuron. It appears that cinosulfuron exhibits higher phytotoxicity in groundnut than in cowpea. The thicker seed coat of cowpea compared with groundnut might have reduced permeability in cowpea seed resulting in lower phytotoxic effect. Similarly, Anonymous [8] attributed the tolerance in cowpea genotype VITA 3 to its thicker testa. Although this herbicide reduced *Alectra* parasitism significantly, its high phytotoxicity in groundnut makes it inappropriate for use as seed treatment herbicide in the crop.

CONCLUSION

Effect of herbicide seed treatment has shown that all rates of imazaquin had no significant effect on *Alectra* population. But groundnut seeds treated with 0.27g a.i.l^{-1} imazaquin out - yielded all other treatments in 1999.Since this dose did not reduce *Alectra* shoot population significantly, it appears that it conferred some tolerance on groundnut to have been able to achieve this superior yield Hence this could be a promising herbicide for use as seed treatment in groundnut. Although cinosulfuron at all rates consistently suppressed *Alectra* infestation, it drastically reduced crop vigour, groundnut pod and kernel yields. This makes the herbicide not suitable for use as seed treatment in groundnut.

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