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Studies on the Effect of Tok E-25 on Weed Control, Growth and Yield of Groundnut (*Arachis hypogaea* L.)*

by

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Introduction: Competition between crop plants and weeds is probably the most important single factor limiting the yield of crops. Groundnut, due to poor competing ability, faces severe weed competition at all stages of its development resulting in ultimate yield losses of more than 50% as reported by Chaugule and Khuspe (1962), Leiderman *et al.* (1963), Kulkarni *et al.* (1963), Boswell (1966) and Mani *et al.* (1968).

The conventional weed control practices like repeated hand weedings and other intercultural operations with country-side implements are not only laborious and costly but also ineffective as timely operations are not guaranteed. The chemical control of weeds in groundnut is gaining much importance in United States of America whereas only a few reports are available in India till now (Singh and Moolani, 1967). The few results achieved also have little practical application.

Research during 1966 at the Regional Research Station (I. A. R. I.), Hyderabad, has resulted in identifying a promising new selective herbicide, 2,4-dichlorophenyl 4-nitrophenyl ether, popularly known under the trademark Tok E-25, containing 25% active ingredient (Anon., 1966). A thorough knowledge of the proper dose, timing of its application, effect on crop and effectiveness over cultural practices in vogue was therefore felt necessary for its popularisation. With these objectives in view, a detailed investigation was undertaken during *Kharif*, 1967 to evaluate the effectiveness of Tok E-25 for groundnut.

Materials and Methods: The treatments consisted application of Tok E-25 at three rates (2, 4 and 6 ltr. a.i. / ha) each applied at three timings *viz.*, pre-sowing (4 days before), pre-emergence I (just after sowing), and pre-emergence II (4 days after sowing). Additional treatments compared in the study were pre-sowing at 4 l. a.i./ha+post-emergence (1 week after) at 2 l. a. i./ha, pre-emergence I at 4 l. a.i./ha+post-emergence (2 weeks after) at 2 l. a.i./ha, pre-emergence II at 2 l. a.i./ha+interculture (30th day), hand weeding+interculture, two hand weedings (20th and 40th day), and no weeding (check). The experiment was laid out in a randomised block design replicated thrice with 15 treatments and net plot size of 9.3 m × 2.7 m.

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The herbicide was applied on active ingredient basis as aqueous spray using 1200 litres of water/ha with a knapsack sprayer.

The soil type of the experimental field was light sandy loam with low fertility status in respect of nitrogen and medium in respect of available phosphorus and potash. The soil reaction was normal (pH 7.2). Ammonium sulphate at 40 kg N, superphosphate at 80 kg P_2O_5, and sulphate of potash at 40 kg K_2O / ha were uniformly applied broadcast as basal fertilization. *Spanish Improved*, an erect bunch type, was sown on 16th July, 1967, adopting a spacing of 30 cm × 15 cm. Harvesting was completed on 2nd November, 1967.

Intensity of weeds in terms of their number and dry matter production at harvest per m^2 was studied. The effects of treatments on the yield contributing characters of groundnut were studied from ten randomly selected plants in each plot and summarised in Table. The dry weight of weeds and haulms were recorded after 30 days of uniform drying in the sun.

The weed population in the experimental plots mainly consists of:

Broad leaved weeds: *Alternanthera echinata*, *Amaranthus spinosus*, *Borreria* spp., *Celosis argentaea*, *Chenopodium album*, *Digera arvensis*, *Eclipta alba*, *Oldenlandia umbellata*, *Heliotropium* spp., *Mullugo* spp., *Phyllanthus madraspathensis*, *Portulaca oleracea*, *Polycarpaea corymbosa*, *Tridax procumbense* and *Vinca pusilla*.

Grasses: *Cyanotis axillaris*, *Digitaria sanguinalis*, *Echinochloa crusgalli*, *Elusine aegyptiaca*, *Eleusine indica*, *Ergrostis major*, *Panicum* spp. and *Sporobolus* spp.

Results and Discussion: The results are presented in Table. *Effect on weeds:* The variations in dry weight of weeds due to treatmental effects were highly significant. All the treatments gave significantly less dry weed weights than no weeding, but the differences between various treatments were not significant.

Rates of application: The main effects of rates of application on dry weight of weeds were highly significant. The herbicide showed broad spectrum of activity by giving excellent control of both annual grasses and broad leaved weeds to the extent of 83–87% with rates of 4 and 6 l./ha respectively. Application of 2 l. a.i./ha controlled the weeds by 70% over no weeding, but differed significantly from both higher rates. Similar trend of these findings was also observed from the data presented on dry weight of weeds per m^2. Application of 2 l. a. i./ha gave significantly higher weed weight of 272 g/m^2 compared to 4 and 6 l. a. i./ha which had minimum weed weights of 105 g and 136 g respectively.

TABLE. *Effect of different treatments on weed control — yield attributes and yield of groundnut*

Treatment No.	Treatment: Rate of application (ltr.a.i./ha)	Treatment: Time of application	Dry weight of weeds (kg/ha)	Percentage weed control	Number of weeds/m²	Dry weight of weeds/m² (g)	Final plant height (cm)	Number of pods/plant	100-pods weight (g)	100-kernal weight (g)	Shelling percentage	Plant population: Plants/ha (thousands)	Plant population: Percentage on hand weeding (100)	Yield of pods (kg/ha)	Yield of haulms (kg/ha)	Percentage of oil
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	2.0	Pre-sowing (4 days before)	5,247	59.0	125	463	29.9	8.2	98.6	40.0	75.1	181.4	100.6	877	2,227	49.2
2.	4.0	Pre-sowing	1,928	54.9	73	146	28.0	16.0	96.1	41.8	75.2	194.6	107.9	1,428	2.315	52.0
3.	6.0	Pre-sowing	1,092	91.5	22	100	26.4	15.2	102.5	42.6	74.9	193.8	107.4	1.531	2,533	49.9
4.	2.0	Pre-emergence-I (just after sowing)	3,937	69.3	118	240	26.9	9.9	100.9	43.6	73.7	183.2	101.5	1,207	2,235	48.0
5.	4.0	Pre-emergence I	1,818	85.8	66	156	26.7	12.0	101.0	41.5	74.1	180.6	100.1	1,569	2,768	50.6
6.	6.0	Pre-emergence I	1.338	89.5	48	120	26.6	11.0	95.9	42.5	73.7	172.7	95.7	1,384	2,494	49.4
7.	2.0	Pre-emergence II (4 days after sowing)	2,266	82.3	71	113	25.8	12.1	99.6	42.9	71.6	182.5	101.1	1,541	2,352	50.2
8.	4.0	Pre-emergence II	2,768	78.4	101	190	28.4	11.9	105.4	42.5	73.3	178.1	98.7	1,491	2.523	48.4
9.	6.0	Pre-emergence II	2,565	79.9	76	190	28.3	12.2	97.1	42.3	73.3	173.0	95.9	1,313	2,656	49.0
10.	4.0+ 2.0	Pre-sowing + Post-emergence	1,718	86.6	192	113	27.0	12.5	92.3	42.6	75.2	184.4	102.2	1,315	2.180	49.3
11.	4.0+ 2.0	Pre-emergence I + Post-emergence	1,171	90.8	89	113	26.3	11.4	103.4	43.2	75.1	177.1	98.1	1,561	2.145	50.3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12.	2.0	Pre-emergence II + Interculture	1,176	90.8	38	46	25.1	14.5	102.1	43.6	73.3	186.9	103.6	1,570	2.603	48.9
13.		Hand Weeding + Interculture	1,114	91.3	13	86	26.4	12.3	94.1	42.4	71.6	176.7	97.9	1,574	2,732	50.1
14.		Two Hand weedings	1,671	86.9	20	53	26.7	12.2	100.3	42.6	72.2	180.4	100.0	1,595	2,857	52.3
15.		No weeding (Control)	12,793	0.0	769	810	36.5	3.3	79.2	38.2	66.8	129.4	71.7	456	1,189	48.1
		'F' test														
		Treatments	Sig.	—	Sig.	Sig.	Not sig.	Sig.	Sig.	Not sig.	Sig.	Sig.	—	Sig.	Sig.	Not sig.
		Rate (R)	Sig.	—	Not sig.	Sig.	Not sig.	Sig.	Not sig.	Not sig.	Not sig.	Not sig.	—	Sig.	Not sig.	Not sig.
		Times (T)	Not sig.	—	Not sig.	Not sig.	Not sig.	Not sig.	Not sig.	Not sig.	Sig.	Not sig.	—	Not sig.	Not sig.	Not sig.
		Interaction (R × T)	Sig.	—	Not sig.	Sig.	Not sig.	Sig.	Not sig.	Not sig.	Not sig.	Not sig.	—	Sig.	Not sig.	Not sig.
		S. E.														
		Treatments	± 546	—	± 52	± 57	± 2.0	± 1.1	± 4.5	± 1.0	± 0.9	± 6.7	—	± 230	± 228	± 0.96
		Rates or Times	± 315	—	± 31	± 33	± 1.2	± 0.6	± 2.6	± 0.6	± 0.5	± 3.9	—	± 133	± 128	± 0.56
		L. S. D. (0.05)														
		Treatments	1.581	—	151	165	—	3.2	12.9	—	2.5	19.4	—	391	642	
		Rates or Times	913	—	—	96	—	1.8	—	—	1.5	—	—	226		

Time of application: The efficiency of herbicide was the same at all timings of application although pre-emergence I (just after sowing) gave maximum weed control of 81.6%.

The interaction between rates and timings of application in respect of dry weight of weeds per m^2 and per hectare was highly significant. Pre-sowing and pre-emergence I treatments each applied at 6 l. a. i./ha gave maximum weed control of 91.5 and 89.5% respectively.

The herbicide showed longer persistence of toxicity on different weed flora for a period of 60–90 days depending upon the rate of application. The weeds which regenerated later could not also compete well with the full grown smothering crop covering mostly both inter-row and intra-row space. The most tolerant weed species encountered in the experiment were *Cyperus* spp. and *Acanthospermum hispidum*, the infestation of which was however not appreciable so as to affect the ultimate yield and quality of the crop due to competitive effects. Further, the growth of *Cyperus* spp. was temporarily checked at higher doses of 4 l. and 6 l. suggesting reduced competition with the crop.

Effect on crop: The variations in yield of pods, haulms, number of pods per plant, 100 pods weight, and shelling percentage due to treatmental effects were highly significant. Plant height, 100 kernel weight, and oil percentage however remained unaffected

Significant increase in yield of pods over control was obtained by both herbicidal and conventional weed control treatments. The differences among these methods were however not significant.

Rates of application: The main effects of rates of application on pod yield were significant and maximum yield of 1496 kg / ha (1040 kg or 228% increase over no weeding) was obtained in 4 l. a. i. / ha which differed significantly from 2 l. a. i./ha (1208 kg pods/ha). An yield of 1409 kg/ha was obtained at 6 l. a. i. / ha which did not differ significantly from either of the other two rates. Yield of pods is the reflection of the effects of the different treatments on growth, development and yield contributing characters of the crop. Favourable effects of the herbicide on yield attributes like plant height, number of pods per plant, 100 pod weight, shelling percentage and oil percentage seem to be much responsible for increased yields obtained at 4 l. a. i. / ha. Further, no deleterious effects on germination, growth and final stand of the crop were observed with the herbicide. Some initial but temporary (10–12 days) necrosis and yellowing of the leaves was however noticed but such symptoms were at low to moderate intensity in both 2 and 4 l. a. i. / ha rates compared to 6 l. Excellent weed control of

about 84% over control was also obtained at 4 l. a. i. / ha and dry weed weight recorded at this rate of application was on par with that of 6 l. rate. From the above discussion it may thus be concluded that 4 l. a. i. / ha would be much safe dose for both effective weed control and increased yields of groundnut.

Time of application: Variation in the timing of application of herbicide did not affect the pod yield and that pre-sowing, pre-emergence I and II applications were equally effective. Similarly number of pods per plant and 100 pods weight were not affected due to differential timings of application. The fact that the weed control was of the same degree at these three timings of application is a clear indication of their identical effects on ultimate yield of the crop. Shelling percentage was however differed significantly and pre-sowing application resulted with maximum of 75% followed by pre-emergence I application (73.8%).

The interaction between rates and timings of application was significant in respect of number of pods per plant and yield. Maximum yield of 1569 kg/ha (1113 kg or 244% increase over no weeding) was obtained by pre-emergence I (just after sowing) spray at 4 l. a. i./ha.

Post-emergence spraying at 2 l. a. i. / ha over pre-sowing and pre-emergence I application (4 l. a. i./ha) did not result with any additional yields over single treatments as was also observed in the case of weed control. On the other hand, the treatments slightly injured the crop due to spray drift on the foliage.

A somewhat similar trend in the behaviour of the treatments was observed in their influence on the yield of haulms which may be attributed to the reasoning put forward in the case of pod yield.

Summary and Conclusions: A field experiment was carried out during *kharif*, 1967 to study the effectiveness of Tok E-25, in controlling weeds of groundnut grown in light sandy loam soil type. The salient features of the experimental findings are (1) both the herbicidal and conventional weed control (two hand weedings, hand weeding+interculture) treatments were equally effective and (2) brought significant reduction in the dry matter production of weeds resulting thereby significant increase in yield of groundnut over control.

Application of 4 l. a. i. / ha proved to be the most superior dose in respect of both weed control and groundnut yield. Further increase in the rate of application did not result with appreciable possitive effects. Variation in the timing of application of herbicide did not affect the dry matter production of weeds and also groundnut yield, and that pre-sowing (4 days before) and pre-emergence I (just after sowing) were equally effective. The interaction between

rates and timings of application in respect of groundnut yield was found significant and pre-emergence I application at 4 l. a.i./ha increased the yield by 244% over no weeding check. Tok E-25 can safely be used as alternative to conventional weed control practices for obtaining additional yields of groundnut and more profits since high costs are involved in the later methods of weed removal.

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