

Recent Studies in the Control of Nut - Grass (*Cyperus rotundus*)

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Cyperus rotundus is a pernicious weed which smothers the growth of crop plants in badly infested fields, specially during the seedling stages of the crop. If the growth of the weed could be arrested by some chemical or agronomic method there will be less competition in the field, and the crop will be able to come up better.

The local method of getting rid of this weed is to work the *Guntaka* or blade harrow in the fields after the receipt of showers during the fallow period or work the country plough before the crop is sown. When the crop is on, the weeds are removed once or twice by means of chisel hoes, engaging human labour.

The spread of *Korai* in the field occurs as follows: A patch of *Korai* has green aerials above the ground surface. An inch below the ground level, lies the fresh, brownish bulb of this aerial. Connected to this with a strong string-like tissue and lower down by about 6 inches, is the second bulb which may have 2 or 3 germinating sprouts on it during wet weather. This is again connected to another bulb 5 or 6 inches still lower down in the soil, which is the third bulb. Lower still, to the entire depth of the soil the bulbs are located at intervals and connected. In a soil of 1½ feet in depth, there may be chains of 4 to 5 bulbs. The lower bulbs are bigger, blacker and look like large beetles. When such a field is ploughed with a wooden plough which goes only to a depth of 2 or 3 inches, many of the aerials with their bulbs are uprooted and disconnected from the lower ones, and the field looks as though it is free from weeds. With the next rain, two sources of infection begin to operate. The first one is the germination of the aerial bulbs which have been thrown up by the plough. These bulbs are fresh and germinate very quickly. The second bulb which is 5 or 6 inches below, beyond the ordinary depth of cultivation, germinates more slowly throwing out 2 or 3 fresh shoots and adds to the aerial population. In fact, the *korai* population after a ploughing and a rain is more than what it was before the ploughing. Some relief is certainly obtained by picking the aerials with their bulbs when they are uprooted by the plough. But this is a slow and costly method.

Deep ploughing in summer exposes a large number of bulbs and they dry up and die, which reduces the infection to a certain extent. (Krishna Rao and Moses, 1949). With this background further

experiments were attempted with a view to check the weed. Some of the phenoxy compounds are reported to be very effective in killing these weeds. Of these "Fernoxone" (or 2-4 D) has been widely used as a weed-killer and reported to have some effect on nutgrass.

To test the effect of Fernoxone in different doses on nutgrass and to compare it with the local practice of hoeing and weeding as control and thereby arrive at an effective and economic method of eradicating *Korai*, an experiment was laid out at the Millet Breeding Station, both under dryland and irrigated conditions. Areas with heavy nutgrass infestation were chosen. The average population of *korai* plants per plot at the commencement of the experiment was 175.

The four treatments tried under dryland conditions in a fallow field were:—

1. Fernoxone 0.2% aqueous solution, (3 sprayings in 2 months)
2. Fernoxone 0.5% aqueous solution, (3 sprayings in 2 months)
3. Digging to soil depth and removal of bulbs during fallow period.
4. Local Cultivation - Weeding and hoeing.

The different treatments were given for the first time on 2-14-1950. In treatments 3 and 4, all the *Korai* plants were removed at the commencement of the experiment. In treatments 1 and 2, the plants showed no sign of wilting till the seventh day after each spraying. On the seventh day, the plants started drying and the leaves began to drop off. Within 12-15 days after spraying all the aerial growths of *Korai* plants dried up completely. The sprayings of Fernoxone were given as and when a spraying appeared necessary as judged by weed growth. Accordingly in two months' time the plots in the first and second treatments had to be given three sprayings. During the corresponding period the local cultivation plots were hand-weeded and hoed once with chisel hoes. At this time nutgrass plants were counted in all the treatments and the results are given below:—

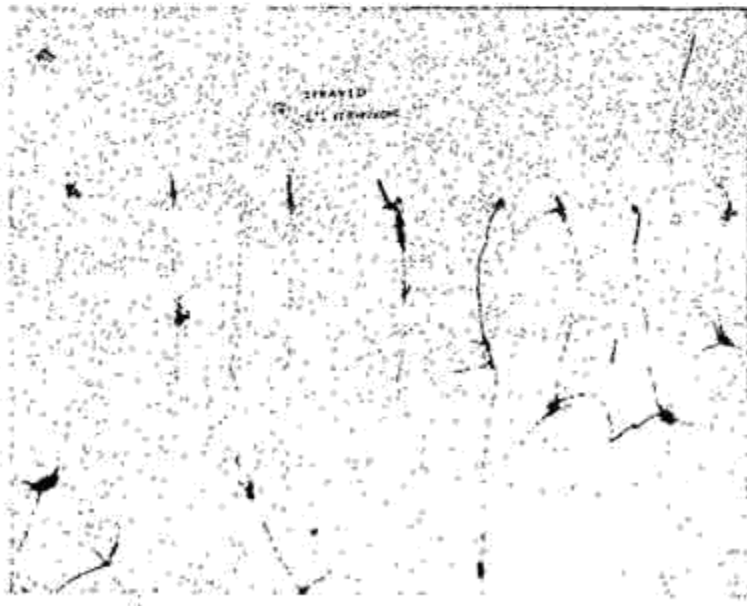
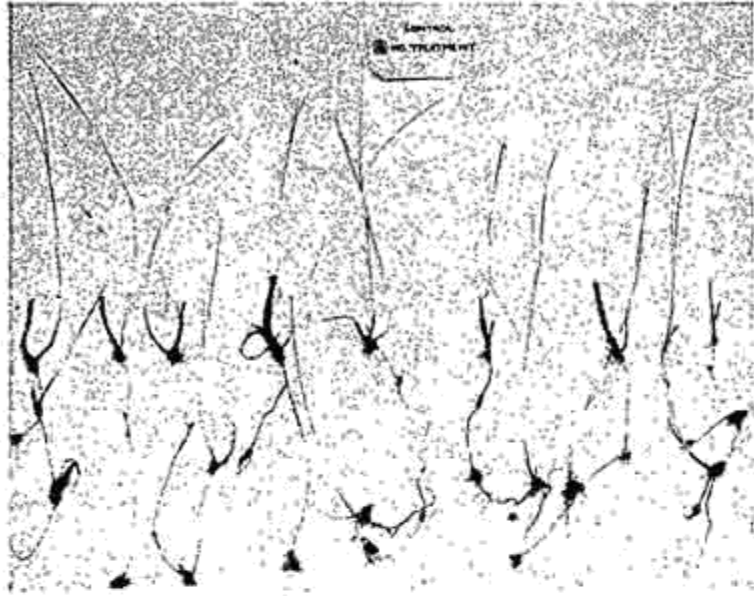
TABLE I

Counts of *Korai* plants (Rainfed plots)

Size of each plot — 2 yards × 1 yard (Fallow land).
 Layout ... Randomised blocks.
 Treatments ... 4.
 Date of commencement 21-4-1950.
 Date of counting 27-6-1950.

Number of new *korai* plants

Treatments	Replications					Total
	1	2	3	4	5	
2% spraying	10	3	2	4	5	24
5% spraying	4	5	7	3	6	22
Digging to soil depth and picking the bulbs.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.
Local cultivation	73	99	42	123	118	455



There is a remarkable difference between the different treatments with regard to weed growth. The treatments killed or removed the aerial plants at the beginning of the experiment.

The new *Korai* plants that came up in the sprayed plots were very few when compared to the control plots. This indicates the amount of suppression of *Korai* that is obtained by spraying Fernoxone as compared to control plots. The third treatment i.e., digging to soil depth and removing bulbs from the soil proved to be the best method as no new *Korai* plants came up after the treatment. Hence to try this treatment on a larger scale, an area of 4.56 cents was dug to the soil depth and all the underground bulbs were removed. But the cost of digging worked out to Rs. 2,800/- per acre. Hence this treatment was rejected as uneconomic. It can however be recommended for ornamental gardens where this weed becomes a nuisance and to small-plot owner cultivators who can do the work themselves in their spare time without paying for labour.

Another experiment was laid out in an irrigated field. The average population of *Korai* plants per plot at the commencement of the experiment was 96. The first, second and fourth treatments were the same. In the third treatment instead of digging and removing bulbs the plots were left without any treatment. Here also weeding and spraying were done whenever it was found necessary. Thus the 0.2% sprayed plots received four sprayings, 0.5% sprayed plots received three sprayings, and local cultivation plots received two hoeings and weedings. The counts were taken on the same day (Table II).

TABLE II
Counts of *korai* plants (Irrigated plots)

Treatments.	Number of New <i>Korai</i> Plants					Total.
	1	2	Replications		5	
			3	4		
0.2% spraying	6	102	22	10	4	144
0.5% spraying	15	30	26	1	Nil.	72
Local cultivation	59	75	76	25	24	259
No treatment	59	260	99	156	17	521

The spraying with the weedicide was less effective in irrigated land. But here also, as under dryland conditions, very few nutgrass plants appeared in the sprayed plots after three or four sprayings of Fernoxone, in comparison to the other treatment plots.

From the above experiment, it appeared that the Fernoxone spray kills the aerals of nutgrass completely. When the dead plants were examined, it was found that their bulbs also were shrivelled. It however allows the appearance of new plants from the underground bulbs.

The next question was whether the effects of Fernoxone was confined to the aerial parts or whether it extended to the bulbs deeper down. Entire chains of bulbs including the aerial, were carefully dug out. These were kept for germination in comparison with similar but untreated *Korai* bulb-chains from control plots. The results are presented below :

TABLE III
The germination of *Korai* bulbs in chains

Treatments	No. of chains of bulbs kept for germination	Germination of		
		Bulb of aerial	2nd bulb	3rd bulb
0.2% sprayed	32	2	6	4
Control	32	32	6	4
Percentage germination of 0.2% sprayed	100	6	19	13
Percentage germination of control	100	100	61	30

A duplicate set of dead aerials with their bulbs were dug out and kept for germination, with untreated *Korai* bulbs as controls. In the plots that received 0.2% and 0.5% spray of Fernoxone, the germination of the bulbs of the aerial was 8 to 12%. In the case of control plots where no spraying was given the germination of aerial bulbs was 92%. Photographs of the chains of bulbs have been appended.

It is seen from the above data, that the lower bulbs are slower to germinate, while the bulbs of the aerials germinate more quickly. Spraying kills practically 90% of the bulbs of the aerials and to a certain extent suppresses the germination of the second and third bulbs also, and thus delays the appearance of new shoots. This gives relief for a longer period during which time the crop is given a chance to come up without weed competition in the early stages.

To see whether spraying *Korai* with 0.5% Fernoxone during the seedling stage of a crop has any effect on yield, consequent on the reduction of weed growth, two plots of 29 links \times 20 links each, which had equally heavy and uniform infestation were marked in a large infested area and one was sprayed with 0.5% Fernoxone and other was kept as control and not sprayed. Spraying was done 18 days after the dryland cholam crop was sown. The cholam seedlings were about one foot high and there was a lot of *Korai* on the ground, the aerials being 2 inches high. Ten days after spraying, *Korai* plants in the 0.5% sprayed plots wilted and dried. The control plots continued to have heavy weed growth. The plot yields taken at harvest are recorded below :

TABLE IV
Yield of plots under treatments

Treatments	Weight of dry straw		Weight of dry earheads		Weight of grain	
	lb.	oz.	lb.	oz.	lb.	oz.
5% spray	11	0	1	9	1	$\frac{1}{2}$
Control (no spray)	7	10	1	2	0	9

The yield in the sprayed plots was 83% higher than in the control plots.

Spraying may thus be given within the first month of the sowing of the crop. In the fallow period a deep ploughing has to be given to destroy as many nuts as are thrown out. A combination of these two controls the weed effectively. Further work is needed to know the effect of continued spraying of *Korai* plants in the same plot over a period of three or four years.

Summary: In the control of *Cyperus rotundus*, by spraying Fernoxone with 0.2% and 0.5% strengths (i.e. 2 gms. or 5 gms. in 1000 c. c. of water) in the fallow period, it was found that two or three sprayings reduced the weed population to about 5% of what it was in untreated plots. It was more effective in drylands than in irrigated fields. Fernoxone spraying killed 90% of the bulbs of the aerial plants and suppressed the germination of the second and third bulbs lower down to a certain extent, thus giving relief for a longer period. In drylands it was found that one spraying of Fernoxone given when the sorghum crop was about a month old, killed the weed and increased the crop yield by about 83%.

LITERATURE CITED

Krishna Rao, P. and Moses, L. (1949) Effect of summer ploughing on the germination of "Korai weed", (*Cyperus rotundus*), Madras Agri. Journ., Vol. XXXVI. No. 6. page 247.

EXPLANATION OF PLATE

In the sprayed plots the bulb of the *Korai* aerals (which are ranged in the first line) have failed to germinate (except in one instance at the right), due to the effect of the treatment. The germination of the second bulbs is also slack. In the control-no treatment plot, the bulbs of the *Korai* aerals (which are also ranged in the first line) have germinated vigorously. The second line of bulbs have also germinated in many cases.

Korai = *Cyperus rotundus* (Nutgrass)
Cholam = Sorghum crop.
Guntaka = Blade harrow.