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EFFECT OF TILLAGE ON WEED POPULATION AND SEED RESERVE IN ARID SOILS

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ABSTRACT

Experiments were conducted to evaluate the effect of differential tillage practices on weed population in rainy season. Zero tillage has been found to be very effective in controlling *Cyperus rotundus* Linn , as the rhizomes do not become free to sprout. Dicots and grasses also showed less presence. However, ploughing the land once or twice and leaving fallow showed insignificant variation in presence of dicots and grasses. The land once prepared and left fallow, and then again ploughed in the same season, resulted in lesser emergence of weeds.

INTRODUCTION

Sen & Chatterji (1968) studied arid zone weeds with regard to their seed germination. They reported that seeds of successive seasons or years remained viable in soil and germinated at the same time whenever favourable conditions occurred. The effect of tillage for managing a large number of weeds is well known. About one half of the tillage operation is practised solely for weed control (Shaw and Loustalot, 1963).

The zero or minimum tillage techniques are more efficient than the conventional and deep tillage as they avoid burial of weed seeds and reduce persistence of annual weeds. These techniques keep the menace of annual weeds to a minimum but often induce vigorous growth of perennial weeds (Peabody, 1970. Triplett and Lytle, 1972). The stale seed bed technique is still more advantageous since the crops germinate in weed-free environment, and if they are selectively stimulated they may close in before subsequent flushes of weed appear on the land (Gupta and Lamba, 1978).

Keeping the above factors in mind, experiments were conducted during 1984-85 to evaluate the effect of differential tillage practices on weed emergence in aridsoils of Rajasthan.

MATERIAL AND METHODS

The experiments were laid at the New Campus, University of Jodhpur, Jodhpur during monsoon seasons of 1984 and 1985 in plots of 15m x5 size, prepared by different number of ploughings (treatments):

Table 1. Effect of frequeney of tillage on weed population (density/m²) observed during samplings I & II

Weed species	Treatment I		Treatment II		Treatment III		Treatment IV		Treatment V	
	I	II	I	II		II	I	II	I	II
Alysicarpus vaginalis	0.33	1.66	20.0	2.6	0.6	—	0.66	1.33	—	—
Borreria articularis	33.6	—	33.3	0.3	18.6	7.0	71.0	29.3	27.0	27.3
Corchorus tridens	—	—	0.33	—	—	0.33	2.66	2.33	31.0	0.6
Cyperus rotundus	8.0	—	26.3	25.0	19.6	11.3	64.0	51.6	21.0	74.6
Dactyloctenium sindicum	—	4.0	—	5.0	0.6	3.0	—	1.6	—	3.0
Dicoma tomentosa	3.6	38.6	41.0	3.6	—	2.0	24.6	24.3	3.3	3.66
Digera alternifolia	0.33	—	0.33	—	—	—	1.33	—	1.0	—
Indigofera cordifolia	15.6	8.33	9.33	2.6	1.0	2.6	1.0	0.33	—	—
Indigofera hochstetteri	5.0	—	6.66	5.3	7.0	5.3	1.33	1.33	—	—
Justicia simplex	0.3	—	1.33	—	—	0.3	—	0.6	1.33	1.33
Tephrosia purpurea	—	—	—	2.0	2.0	—	0.33	0.33	—	—
Tribulus terrestris	6.0	3.0	3.66	0.6	2.0	1.0	0.33	0.33	—	—

I. Not disturbed since 1983 (zero tillage).
II. Ploughed once in 1984 and left thereafter (Zero tillage).
III. Ploughed twice in 1984 and left thereafter.
IV. Ploughed twice in 1984 and once in 1985.
V. Ploughed twice in 1984 and 1985.

The seed reserve in the soil was assessed by studying the soils from five different sites collected from different depths (0, 15 and 30 cm) and germination was recorded. The weeds which appeared in the pots were computed per m^2. Species similarity indices (ISs) were calculated for all the plots and the sets of plots prepared by the same number of ploughings but in different years, using the formula of Sorenson (1948) :

$$ISs = \frac{\text{No. of common species at all sites}}{\text{Average of total no. of spp at all sites}} \times 100$$

RESULTS AND DISCUSSION

The weed appearance study showed that in zero tillage (Treatment I) only 13 species appeared. Weeds like *Convolvulus microphyllus* Sieb. ex Spreng, *Cyperus rotundus* Linn., *Digera alternifolia* Linn., *Euphorbia prostrata* Ait., *Indigofera hochstetteri* Baker, *Justicia simplex* D. Don and some grasses had a low presence in the first sampling and completely disappeared in the second sampling. *Borreria articularis* (Linn.) F.N. Will although showed a maximum density of 33.6 plants/m^2 during first sampling, but completely disappeared in the second sampling. *Dicoma tomentosa* Cass., however, became abundant (38.6 plants/m^2) in second sampling due to its ability to survive for a longer duration even with the depletion of soil moisture. However, when the land was ploughed only once (Treatment II) the weed species increased from 9 to 16 during second sampling. Additionally, *Corchorus tridens* Linn., *Celosia argentea* Linn., *Digitaria adescendens* (H.B.&K.) Henr., *Heliotropium marifolium* Koen. ex Retz, and *Cenchrus biflorus* Roxb. also appeared, but in very low density. Seth et al. (1971) and Moody (1982) also reported a low number of weeds in untilled plots than in tilled ones. Species similarity index (ISs) between treatment I and II was 68.9% and later increased to 73.6%. Treatments with one and two ploughings in 1984 showed the presence of 15 and 16 weed species in first and second sampling. The land, when left fallow after one and two ploughings (Treatment IV and V), did not show any reduction in weed species. William Froud et al. (1981) reported that reduced cultivation increased the incidence of annual and perennial grass population and certain biennial and perennial dicots. The ISs between treatments I & III & II and IV increased from 50 and 54 to 60 and 76% and between Plot I & V and Plot II & V decreased from 60.0 to 37.5 and 60.8 to 47.61 during second sampling. There were 21 weeds in treatment IV.

In treatment V weed species like *Cleome viscosa* Linn., *Convolvulus microphyllus* Sieb. ex Spreng, *Dactyloctenium sindicum* Boiss., *Euphorbia granulata* Forsk., *E. prostrata* Ait., *Gisekia pharnacioides* Linn., *Oligochaeta ramosa* (Roxb.) Wagenitz, *Polygala chinensis, Polycarpaea corymbosa* (Linn.) Lamk., and *Tephrosia purpurea* (Linn.) Pers, were present in a low density but the total number of all weeds was quite low in Treatment V. Nevertheless, *C. rotundus* appeared more (74 Plants/m^2), obviously not affected by one or two ploughings. Sen et al. (1984) observed that plots receiving intermittent rains soon after the land preparation caused the exposed rhizomes to sprout and produce new plants and rhizomes escaping desiccation. Zero tillage did not favour the rhizomes to sprout. Only a few dicot weeds such as *Alysicarpus vaginalis*, *Borreria articularis* (Linn.) F.N. Will, *Corchorus tridens* Linn., *Justicia simplex* D. Don. and *Polycarpaea corymbosa* (Linn.) Lamk. appeared in treatment V. The species similarity was initially the least for treatment III and IV.

Single tillage operation in a season appeared to induce many weeds to emerge against zero tillage which reduced the number of emerging weed species. *B. articularis* and *C. rotundus* also showed maximum density in treatment of single ploughings (treatments II & IV) but their density became very less. The species similarity index, when compared at all sites together, remained very low (Table 2).

Table 2. Species similarity index (ISs) for weed stands between the plots in different treatments.

Samplings	All ISs between treatments					
	I & II	I & III	I & V	II & IV	II & V	III & V
I	20.0	68.9	50.0	60.0	54.0	60.8	18.18
II	34.4	73.6	60.0	37.5	75.8	47.6	63.66

Seed reserve in soil collected from different cultivated fields (sites I-V) revealed that shallow ploughing gave maximum number of weeds, i.e. *Borreria articularis*, *Brachiaria ramosa*, *Corchorus tridens*, *Convolvulus microphyllus*, *Dactyloctenium aegyptium*, *Gisekia pharnacioides* Linn., *Indigofera hochstetteri* Baker and *Tribulus terrestris* Linn. The field which was prepared and left fallow exhibited similar weed flora but to a lesser extent. Only *Aristida funiculata* Trin. et. Rupr. and *Boerhavia diffusa* Linn, appeared from the soil of the field which was left fallow. Soil collected from 15 cm depth showed maximum presence of perennial weeds like *Convolvulus microphyllus*, *Cenchrus biflorus* Roxb. and *Tephrosia purpurea* (Linn.) Pers. Soil collected from 30 cm depth from the fields prepared by deep ploughing showed the maximum presence of *Indigofera cordifolia*, *I. hochstetteri*, *Corchorus depressus* (Linn.) Christensen, *Tragus biflorus* (Roxb.) Schult. and some grasses.

It is concluded that land with one ploughing and left fallow for sometime and again ploughed for the second time in the same season had reduced number of weeds.

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