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EFFECT OF BURIAL DEPTH AND CULTURAL PRACTICES ON NUTLETS EMERGENCE AND VIABILITY OF *Cyperus rotundus* L. UNDER UP LAND CONDITIONS IN THE DRY ZONE, SRI LANKA.

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Abstract

Cyperus rotundus known as purple nutsedge is identified as one of the problem weeds. The underground nutlets in the soil bank are the propagules. Vigorous nutlets are capable of emerging from deep soil profile of 30 cm. The nutlets buried in the top 0-15 cm layer loose its viability quickly than the nutlets buried in deeper layer of 15-30 cm.

Continuous land preparation helped to bring the nutlets to the upper surface where they were desiccated due to high temperature and loose viability. Nutlet viability in the upper layer of 0-15 cm reduced from 82% to 2% in 105 days due to continuous land preparation. The same land preparation reduced the nutlet viability from 88% to 14% in the deeper layer of 15-30 cm in 105 days.

Continuous mulching for four months with palmyrah leaf reduced the nutlet viability from 80% to 10% in the upper layer of 0-15 cm and 86% to 26% in the lower layer of 15%-30%.

Mulching with black polythene was found to be better than palmyrah leaf in reducing the nutlet viability. It reduced the viability from 80% to 6% in upper layer and 86% to 9% in lower layer in four months time.

keywords: : *Cyperus rotundus*, land preparation, mulching, nutlet, viability.

1 Introduction

Cyperus rotundus belongs to family Cyperaceae and also known as purple nutsedge, nut grass, purple nut grass and mothi. It is considered as one of the world worst weed due to it's aggressive nature, persistent growth and resistant to control. It was recorded as serious weed in 52 countries around the world [1] This weed can remove 95.6 kg nitrogen, 11.6 kg phosphorus and 42.3 kg potash from one hectare [2] Reduction of crop yield due to this weed varies from crop to crop. *Cyperus rotundus* has an Allelopathy effect on mustard, barley and cotton crop [2] This deep-rooted perennial weed can produce numerous underground propagules referred to as nutlet. Single nutlet can produce as many as 100 nutlets within four months [2] It grows very rapidly and can produce around 1000 nutlets in one square meter [1] These nutlets are the primary propagules, which can remain dormant in the soil bank for a long period. Reducing the viability of nutlets in the soil bank is the only way to control *Cyperus rotundus.* With this view, experiments were carried out to study the effect of burial depth, continuous land preparation and mulching on the emergence and viability of nutlet.

2 Methods and materials

Three different experiments were carried out at the Faculty of Agriculture, University of Jaffna from March 2001 to August 2001 on the emergence and nutlet viability of *Cyperus rotundus.*

2.1 Effect of burial depth on nutlet emergence

In this experiment 100 newly formed uniform size nutlets of *Cyperus rotundus* were planted at 10 cm, 20 cm, and 30 cm depth separately in the ditches of one square meter and irrigated regularly. Number of emerged nutlets was recorded at weekly interval up to 3 weeks. This was replicated in three locations.

2.2 Effect of continuous land preparation

Field, which was heavily infested with *Cyperus rotundus*, was selected for this experiment. Land was prepared with hoe and allowed for 15 days. After that, 100 nutlets were collected from each of 0-15 cm and 15-30 cm layer separately from randomly selected 4-location and tested for viability. After obtaining nutlets for viability test, the same land was again prepared with the hoe and the nutlets were taken after 15 days for viability test. This process continued for a period of 4 months.

2.3 Effect of mulching on nutlet viability

Mulching of field heavily infested with *Cyperus rotundus* was done with palmyrah leaves and black polythene separately. Nutlets from both palmyrah and black polythene mulch experiments were collected from two layers of 0-15 cm and 15-30 cm separately from randomly selected 4 locations at monthly interval to test the viability. This experiment was continued for four months. Hundred nutlets were collected for each viability test.

3 Results and discussion

3.1 Burial depth and emergence of nutlet

It was found that the nutlets planted at 10 cm and 20 cm depth germinated and emerged within a week time while the nutlets from 30 cm depth emerged after two weeks. Germination and emergence are almost completed in two weeks time from the 10 and 20 cm burial depth. Nutlet emergence continued up to 3 weeks in 30 cm burial depth. At the end of 3rd week 90% of the nutlet emerged from 10 cm burial depth while 82% and 52% emerged from 20 cm and 30 cm depth respectively (Table 1). After 3 weeks all ditches were carefully examined to count the germinated nutlets that failed to emerge. It was found that all the nutlets germinated from 10 cm depth emerged. In the 20 cm depth treatment, only 4% of the nutlets that were germinated failed to emerge. In the case of 30 cm burial depth, 19% germinated nutlets failed to emerge. This shows that the nutlets are capable of emerging even

Table 1: Emergence of nutlet from different burial depth (Average of three locations)

Burial depth (cm)	Numbers of nutlets emerged			
	1st week	2nd week	3rd week	Number of nutlets germinated but failed to emerge after 3 weeks.
10	64^a	88^a	90^a	0
20	55^b	75^b	82^a	4
30	0^c	37^c	52^b	19

* Figures denoted by the same letter in each column do not differ significantly at $P \leq 0.05$, based on DMRT.

from 30 cm depth. When the burial depth increases, emergence of nutlets decrease. The nutlets that were germinated and failed to emerge from the depth of 30 cm could be attributed to the low nutlet vigour. The nutlet, which has adequate food reserves are vigorous, and can emerge even from 30 cm depth. Until the germinated shoot emerge above the soil and involve in photosynthesis, the food reserve in the nutlet has to sustain the growth of the shoots. Therefore the nutlet, which has less food reserve, cannot sustain the growth to emerge from the deep layer.

3.2 Effect of continuous land preparation on nutlet viability

Continuous land preparation at 15 days interval significantly reduced the nutlet viability both in the upper layer of 0-15 cm and lower layer of 15-30 cm. The initial nutlet viability before land preparation was 82% in the upper layer and 88% in the lower layer. This nutlet viability in the upper layer was reduced to 9% after 60 days and 2% after 105 days of land preparation. In the lower layer of 15-30 cm, the initial viability before land preparation was 88% and reduced to 21% after 60 days and 14% after 105 days (Table 2).

Table 2: Effect of continuous land preparation on nutlet viability (Average of four locations)

Depth (cm)	Nutlet viability after continuous land preparation							
	Initial viability before land preparation	15 days	30 days	45 days	60 days	75 days	90 days	105 days
0-15	82	66	18	13	9	4	3	2
15-30	88	73	39	36	21	20	19	14

The nutlet viability in the top 0 - 15 cm layer was significantly lower than that of lower layer of 15-30 cm. Continuous land preparation helps to bring the nutlets to the upper surface where they were exposed to sunlight and desiccated due to high temperature. Further during land preparation soil is loosened and thereby increases the soil temperature, which in turn help to reduce the nutlet viability due to desiccation. Land preparation also help to detach the nutlets from parental plant and break the nutlet dormancy. When these nutlets are brought to the top layer they either loose viability or will die after emergence. This process help to reduce the nutlet propagule in the soil bank.

Loss of viability is high in upper layer than lower layer due to the exposure to direct sunlight. It was reported that the exposure of nutlets to sunlight for 14 days resulted in a total loss of viability [3] Nutlets buried in the lower layer could escape the adverse effect of soil and climate and thereby retain their viability.

3.3 Effect of mulching on nutlet viability

Continuous mulching with black polythene and palmyrah leaves reduced the nutlet viability. The initial nutlet viability before mulching was 80% and 86% in the top 0-15 cm layer and 15-30 cm layer respectively. In the black polythene mulching, nutlet viability was reduced from 80% to 6% in the top 0-15 cm layer and 86% to 9% in the 15-30 cm layer after four months (Table 3).

Mulching with palmyrah leaves reduced the nutlet viability from 80% to 10% in the top 0-15 cm layer and 86% to 26% in the 15-30 cm layer after four months. Black polythene mulching significantly reduced the nutlet viability over palmyrah

Table 3: Effect of continuous mulching on nutlet viability (Average of four locations)

Mulching	Soil depth (cm)	Initial viability before mulching	Nutlet germination percentage			
			End of 1st month	End of 2nd month	End of 3rd month	End of 4th month
Black polythene	0-15	80	60	12	8	6
	15-30	86	75	29	21	9
Palmyrah leaf	0-15	80	64	22	15	10
	15-30	86	88	45	37	26

leaves mulching both in upper and lower layer. This could be attributed to the increased soil temperature in the black polythene mulching compared to palmyrah leaves. Nutlet viability in the lower layer of 15-30 cm is higher than that of upper layer (0-15 cm) both in black polythene and palmyrah leaf mulching. This could be attributed to the high soil moisture and low temperature in the lower layer than upper layer.

It was observed that mulching cut off the sunlight completely and thereby suppressed the shoot growth. Under such condition, nutlets in the soil bank deplete their food reserve due to respiration and thereby lose their viability. Shading reduces the shoot growth, nutlet production and nutlet viability [4]

4 Conclusion

Nutlets in the soil bank are the propagules that produce new plants. Therefore the strategies to control *Cyperus rotundus* in a given location should be

a) Reducing the viability of existing nutlets in the soil bank

b) Reducing the formation of fresh nutlets

c) Prevention of nutlets transported from other lands.

Under normal situation, nutlet in the top layer loses viability quickly than nutlets buried in the deeper layer. Continuous land preparation can reduce the nutlet viability by bringing them to the surface and subjecting for desiccation. It also disturbs the shoot growth and thereby reduces the new nutlet formation. Mulching is found very effective in reducing the nutlet viability. Continuous mulching for a period of four months can reduce the nutlet viability to the significant level. Therefore farmers can mulch their field while allowing to fallow for a certain period. This practice will help to reduce the existing viable propagules in the soil bank.

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