



Control of purple nutsedge in okra through integrated management

M. Ameena*, V.L. Geetha Kumari and Sansamma George

Department of Agronomy, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala 695 522

Received: 8 February 2013; Revised: 24 March 2013

ABSTRACT

Field experiments were conducted to study the effect of integrated weed management practices on growth, regeneration and tuber viability of purple nutsedge in okra for two years during summer seasons at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala, India. Eleven treatments tested in RBD with three replications were combinations of stale seedbed with glyphosate application and black polythene mulching, eucalyptus leaf mulching and cowpea smother cropping in relation to weed free and weedy check. Among the treatments, stale seedbed combined with pre-plant application of glyphosate 1.5 kg/ha (before sowing okra) followed either by polythene mulching or directed application of glyphosate 1.5 kg/ha between rows of okra was the most effective treatment in controlling nutsedge tuber production. Tuber viability and regeneration were lowest under stale seedbed in combination with pre-plant followed by post-emergence directed application of glyphosate or black polythene mulching. A combination of stale seedbed with glyphosate application followed by black polythene mulching was the best treatment for nutsedge management in okra.

Key words: Nutsedge, Regeneration, Solarisation, Stale seedbed, Tuber viability

Okra is one of the important vegetable crops grown throughout Kerala during summer. The problem of weeds is severe in okra as it is initially slow growing and incapable of offering competition to the aggressive weeds. During warm-season, perennial sedges especially purple nutsedge (*Cyperus rotundus* L.), is a serious problem as light and frequent irrigations cause their underground propagules to germinate in flushes. Research workers from time to time have suggested various cultural, mechanical, chemical and biological control measures, yet this weed continue to infest vast productive land and still remain as the tropical scourge in cultivated crop. The longevity of tubers, the ability of tubers to sprout several times, and lack of herbicides that can kill dormant tubers have made purple nutsedge control difficult. Glyphosate is promising in effective control of purple nutsedge since it translocate rapidly to the tubers (Bhatia *et al.* 2000). However, herbicide application alone can not completely manage the weed because of its failure to control or desiccate the dormant tubers. Hence, the present investigation was undertaken to study the effect of integrated weed management practices on regeneration and tuber viability of purple nutsedge in okra.

MATERIALS AND METHODS

Field experiments were undertaken at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala, India dur-

ing summer season for two consecutive years in a nutsedge infested area to study the effect of cultural practices along with herbicides on nutsedge growth, regeneration and tuber viability in okra field. Soil of the experimental site belonged to the taxonomical class, loamy kaolinitic isoheperthermic, rhodic haplustox, low in available nitrogen, medium in available phosphorus and potassium with a pH 5.2. The experimental site was lying fallow and was completely infested with nutsedge. The experimental site was ploughed, clods broken, stubbles removed and the field was laid out in randomised block design with three replications. Recommended package of practices was adopted to raise the experimental crop. Treatments consisted of combinations of stale seedbed with glyphosate application and polythene mulching, eucalyptus leaf mulching, cowpea smother cropping along with weed free and weedy check (Table 1).

Stale seedbeds were prepared by digging the field during the month of February to expose and break the nutsedge tuber chains. This was followed by irrigation to stimulate sprouting of dormant tubers. Glyphosate 1.5 kg/ha was sprayed after one month of growth as pre-plant spraying *i.e.* before sowing okra and as post-planting direct spraying after one month of sowing between rows along with hand weeding between plants. Black polythene sheets of 300 gauge thickness were used as the mulching material. For imposing the treatment, the land was thoroughly levelled and holes of 12 cm diameter were made

*Corresponding author: drameenaubaid@gmail.com

Table 1. Effect of weed management practices on reduction in nutsedge population, shoot dry weight and tuber dry weight

Treatment	Percentage reduction in nutsedge population			Percentage reduction in nutsedge shoot dry weight			Percentage reduction in nutsedge tuber dry weight		
	I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
	T ₁ - Stale seedbed + glyphosate + HW	32.6	31.5	32.1	49.0	33.7	41.4	50.7	37.5
T ₂ - Stale seedbed + glyphosate + polythene	67.5	82.6	75.1	50.6	67.7	59.2	74.1	72.5	73.3
T ₃ - Stale seedbed + glyphosate + eucalyptus	52.2	29.4	40.8	41.6	38.3	39.9	45.8	45.4	45.6
T ₄ - Stale seedbed + glyphosate + cowpea	26.9	26.5	26.7	35.5	20.5	28.0	18.6	15.9	17.3
T ₅ - Stale seedbed + glyphosate + glyphosate (pre and post)	65.9	64.8	65.3	51.7	59.3	55.5	67.6	62.3	64.9
T ₆ - Soil exposure + HW	30.2	40.2	35.2	30.5	39.5	35.0	53.1	40.9	47.0
T ₇ - Soil exposure + polythene	71.2	72.7	71.9	54.7	70.7	62.7	49.3	64.9	57.1
T ₈ - Soil exposure + eucalyptus	15.3	36.8	26.0	34.3	23.4	28.8	23.2	42.8	33.0
T ₉ - Soil exposure + cowpea	41.7	22.1	31.9	57.6	23.3	40.5	46.7	21.1	33.9
T ₁₀ -Weedy check	-13.9	-27.2	-20.5	-59.8	-57.2	-58.5	-151.7	-92.6	-122.2
T ₁₁ -Weed free	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
LSD (P=0.05)	22.4	21.1	8.8	-	13.0	-	23.8	10.8	NS

HW - Hand weeding; NS - Non significant

on polythene sheet at 60 and 30 cm distance and the sheet was spread on the whole plot. Dry leaves of eucalyptus were used as the mulch material at 10 t/ha. Three rows of cowpea cv. 'C-152' were raised in between two rows of okra at a spacing of 15 cm and were mulched at 25 days after sowing. In soil exposure plots (T₆ to T₉), the land was dug well and exposed to sun for three days for desiccation of the underground tubers.

The okra cv. 'Varsha Uphar' was sown on ridges at a spacing of 60 x 30 cm. In each plot, 0.1m² area was marked and kept undisturbed after imposing the treatments and new sprouts appeared were recorded at weekly interval to assess the regeneration rate. After the application of treatments, ten tubers were collected at random from each plot, detached and the individual tubers were kept in Petridishes for testing the tuber viability. Number of tubers germinated were counted at two and three weeks after sowing and expressed as percentage. Weed data were subjected to log ($\sqrt{x+1}$) transformation.

RESULTS AND DISCUSSION

Effect on nutsedge growth

Among the treatments, black polythene mulching in combination with stale seedbed recorded maximum reduction in all growth parameters of nutsedge. During first year, the lowest nutsedge population was recorded by stale

seedbed with pre- and post-emergent herbicide application with a reduction percentage of 65.9%. However, solarisation with polythene mulching was the most successful in bringing down the nutsedge population in both the years (71.2 and 72.7%). The pooled analysis data indicated the superiority of polythene mulched plots in combination with stale seedbed. Regarding shoot dry weight, polythene mulching was the most effective in bringing down the nutsedge shoot production (Table 1). However, stale seedbed combined with polythene mulching was the most effective in controlling nutsedge tuber production in both the years.

By stale seedbed technique, the dormant underground tubers were stimulated to sprout and the sprouted shoots were killed by glyphosate spraying which reduced the weed seed bank or dormant tuber reserve in soil. The cost effectiveness of stale seedbed to achieve nutsedge control in rice-vegetable cropping system was reported by Islam *et al.* (2009) and John and Mathew (2001). Post-emergence glyphosate application after stale seedbed was found to show spectacular inhibitory effect on nutsedge multiplication and spread and this treatment recorded the highest percentage reduction of nutsedge population, shoot and tuber. The effectiveness of glyphosate 1.5 kg/ha in controlling nutsedge was in conformity with Ameena (1999) who reported nutsedge without regeneration for a

Table 2. Effect of weed management practices on regeneration count (no./ 0.1 m²) and tuber viability of nutsedge (%)

Treatment	Number of tuber sprouts/0.1 m ²				Tuber viability (%)	
	Regeneration – I year		Regeneration – II year		I year	II year
	I WAH	3 WAH	I WAH	3 WAH		
T ₁	11.3	15.7	9.3	12.7	33.3	43.3
T ₂	8.7	9.0	3.3	7.0	30.0	26.7
T ₃	13.7	20.0	16.0	16.0	36.7	63.3
T ₄	19.0	23.3	16.0	20.3	40.0	46.7
T ₅	4.7	8.0	4.3	6.0	23.3	20.0
T ₆	17.0	20.0	14.0	16.7	43.3	46.7
T ₇	8.7	12.3	6.3	9.3	33.3	26.7
T ₈	20.7	24.0	20.0	20.3	33.3	46.7
T ₉	25.9	23.7	16.3	20.7	36.7	53.3
T ₁₀	-	-	-	-	63.3	83.3
T ₁₁	10.7	13.7	9.3	10.3	66.7	80.0
LSD (P=0.05)	1.2	3.9	3.0	2.9	8.9	9.8

WAH-Weeks after harvest; Treatment details are given in Table 1

period of six weeks. Wangchengyuh (2001) also reported that glyphosate caused inhibition of bud elongation, increased total free amino acids concentrations and caused rapid accumulation of shikimic acid in sprouted tubers. These studies suggested that spraying of glyphosate at 1.5 kg/ha prevented regeneration of nutsedge tuber.

Effect on nutsedge regeneration and tuber viability

During the entire period of study, stale seedbed with pre and post-planting glyphosate application was the best treatment in controlling regeneration of nutsedge with the lowest tuber viability (23.2%). Glyphosate is a translocated herbicide which moves to underground organs and appears to inhibit the aromatic amino acid biosynthetic pathway (Jawarski 1972). In purple nutsedge, glyphosate moves basipetally into the shoots and tubers with its translocation increased from 5% at 1 day to 19% at 4 days after application and accumulation is greater in tubers than in leaves (Reddy and Bendixen 1988).

Black polythene mulching integrated with stale seedbed was also found superior in later stages in reducing the regeneration of nutsedge in terms of tuber viability as the viability of tubers collected from these plots recorded the lowest values. This could be due to the higher temperature developed under black polythene sheets which made them non-viable. The effectiveness of black polythene

mulch in reducing nutsedge growth has been reported by Yadav *et al.* (1996) stating that black polythene mulching after one hand weeding could provide more than 98% control of *Cyperus rotundus*.

Purple nutsedge stored more food in tubers and exposure to higher temperature desiccated the tubers in the shallow soil more than in the deeper depths. Tubers that survived desiccation due to their placement in deeper depths of soil have a better chance of producing new plants when they contain more stored food. Similar findings have been made by Patterson (1998) who observed that shoots that develop under the mulch produce no tubers. Highest regrowth and viability percentages recorded in weedy check plots with no herbicides revealed that newly formed tubers of purple nutsedge sprouted readily showing no seasonal dormancy which is important in integrating approaches that may direct weed management priorities on depleting or inhibiting the tuber reserve.

Thus for management of nutsedge in okra, adoption of stale seedbed followed by application of glyphosate 1.5 kg/ha *fb* black polythene mulching or directed application of glyphosate 1.5 kg/ha between rows of okra was the effective method to cause reduction in shoot weight, tuber weight and number of tubers with lower tuber viability.

REFERENCES

- Ameena M. 1999. *Investigations on allelopathic influence and control of purple nutsedge (Cyperus rotundus L.)*. M.Sc. (Ag.) thesis, Kerala Agricultural University, Thrissur. 165 p.
- Bhatia RK, Singh S and Mehra SP. 2000. Regeneration potential of *Cyperus rotundus* as influenced by application of glyphosate and glufosinate ammonium, p. 67. In: *First Biennial Conference in the New Millennium on Eco-friendly Weed Management options for Sustainable Agriculture*, Organised by Indian Society of Weed Science, May 23–24, 2000.
- Islam MN, Baltazar AM, Datta SK and Karim AN. 2009. Management of purple nutsedge (*Cyperus rotundus* L.) tuber population in rice-onion cropping systems. *Philippine Agricultural Scientist* **92**(4): 407–418
- Jawarski EG. 1972. Mode of action of N-phosphonomethyl glycine- Inhibition of aromatic amino acid biosynthesis. *Journal of Agricultural and Food Chemistry* **12**: 1195–1198.
- John PS and Mathew R. 2001. Stale seedbed an alternate technology for pre-planting to achieve total weed control in direct seeded low land rice. *International Rice Research Notes* **26**: 67–68.
- Patterson DT. 1998. Suppression of purple nutsedge (*Cyperus rotundus*) with polyethylene film mulch. *Weed Technology* **12**: 275–280.
- Reddy KN and Bendixen LE. 1988. Toxicity, absorption, translocation and metabolism of foliar applied chlorimuron in yellow and purple nut sedge. *Weed Science* **36**: 707–712.
- Wangchengyuh. 2001. Effect of glyphosate on aromatic amino acid metabolism in purple nutsedge (*Cyperus rotundus* L.). *Weed Technology* **15**: 628–635.
- Yadav A, Balyan RS, Malik RK, Rathe SS, Banga RS and Pahwa SK. 1996. Role of soil solarisation and volume of glyphosate spray on the control of *Cyperus rotundus* in Ber. *Indian Journal of Weed Science* **28**: 26–29.