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Research Article

EFFECT OF PRE-EMERGENCE HERBICIDE APPLICATION ON GERMINATION AND GROWTH OF DIRECT SEEDED FINGER MILLET (*Eleusine coracana* L.) UNDER DIFFERENT SOIL MOISTURE REGIMES

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Abstract: Weeds are of major concern in direct sown finger millet production and hence its management is a very complicated task. Keeping weeds under check to further boost the growth and to enhance the yield of finger millet is a very vital issue as the problem of germination failure and toxicity is being noticed for pre-emergence herbicides usage in finger millet under direct sown situation. The present investigation was formulated to evaluate the effect of pre-emergence herbicides on germination and growth of direct seeded finger millet under different soil moisture regimes. From the study it can be concluded that pre-emergence application of oxyflurofen 23.5 EC @ 60 g a.i. /ha and butachlor 50 EC @ 600 g a.i. /ha followed by adequate soil moisture by irrigation or rainfall during germination period significantly lowered germination of direct seeded finger millet along with initial phytotoxicity symptoms such as stunted growth.

Keywords: Weeds, Pre-emergence, Finger millet, Toxicity, Germination

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Introduction

Finger millet (*Eleusine Coracana* L. Gaertn) is an important food and fodder crop in dry land areas of the country especially in southern Karnataka. It is cultivated in an area of 5.98 lakh hectares with a total production of 8.59 lakh tonnes and an average productivity of 2050 kg ha-1.Although the area under cultivation is being reduced due to major production constraints and low socio economic status associated with the crops but the demand for it has started to increase because of its potential health benefits. The crop is mostly grown on marginal and light textured soils and less importance is given towards its cultivation practices. As such more than 90 percent of finger millet cultivation is under rainfed situation, direct seeding is the usual method of sowing adopted by majority of the farmers. By virtue of its narrow leaf canopy and slow initial growth, the crop is dominated by weeds and hence severe competition for nutrients, moisture and space at its earlier stage attributing to yield loss of about 20-50%. Weeds are of major concern in direct sown finger millet production and hence its management is a very complicated task. Keeping weeds under check to further boost the growth and to enhance the yield of finger millet is a very vital issue. Chemical method of weed control is the left out option for marginal farmers to control the weeds efficiently and economically. The problem of germination failure and toxicity is being noticed for pre-emergence herbicides usage in finger millet under direct sown situation. Further, the germination failure and toxicity are correlated to anticipated soil moisture as due to unexpected rainfall after application of pre-emergence herbicides under dry lands. With this perspective, the present investigation was formulated to evaluate the effect of pre-emergence herbicides on germination and growth of direct seeded finger millet under different soil moisture regimes.

Materials and Methods

A field investigation was carried out during *Kharif* 2018 at Zonal Agricultural Research Station, V.C. Farm, Mandya. The soil of the experimental site was red sandy loam in texture with normal fertility status of low in available nitrogen (243.2 kg/ha), medium in available phosphorus (45.17 kg/ha) and medium in potassium (210.07 kg/ha) with soil pH of 6.86. The experiment was laid in randomized block design replicated thrice. The sixteen treatments comprised of combination of two pre-emergence herbicides *viz*., Oxyflurofen 23.5EC@60 g a.i./ha and Butachlor 50 EC @ 600 g a.i./ha and seven moisture regimes (*viz*., irrigation before sowing, irrigation on the day of spraying, irrigation 1,2,3,4 and 5DAS) were compared with hand weeding at 20 and40 DAS and Unweeded control [Table-1]. The variety used for sowing was KMR-301 and at the time of sowing half the recommended dose of nitrogen (30 kg/ha) and complete dose of P2O5 and K2O (40 and 20 Kg/ha, respectively) were applied as basal application. The remaining 50 % nitrogen (30 kg/ha) was used for top dressing after 30 DAS. During the experimentation period the moisture was maintained as per the treatments to study the toxicity effect of herbicides on germination of finger millet. Visual phyto-toxicity ratings with 0-4 scale (*viz*, 1- No effect on germination and no stunted growth, 2-50% germination affected and no stunted growth, 3- 75% germination affected and 75% stunted growth and 4-100% germination affected and stunted growth). where were recorded at 10, 15, 20 DAS. Germination percentage was also recorded at 20DAS. Growth parameters such as plant height and number of leaves per plant were recorded at 20 and 30 DAS on randomly selected five plants. The data on germination percentage was transformed using arc sign transformation and statistically analyzed using ANOVA.

Results and Discussion

The pre-emergence application of herbicides caused significant affect on lowering germination of finger millet [Table-1].The Germination of finger millet at 20 DAS reduced due to irrespective of irrigation with pre-emergence application of oxyflurofen 23.5 EC @ 60 g a.i. /ha and butachlor 50 EC @ 600 g a.i. /ha (5 to 22%) and were significantly lower as compared to the hand weeding and unweeded check (59.3 to59.7%). The visual phyto-toxicity symptoms were recorded at 10, 15 and 20 DAS and are presented in [Table-2]. The visual phyto-toxicity symptoms were recorded *viz*. 0 to 4 scale as mentioned in materials and method.

Table-1 Germination percentage and visual phytotoxicity ratings of finger millet as influenced by pre emergence herbicide application under different soil moisture regimes

Treatments	Germination Percentage (20 DAS)	Phytotoxicity ratings		
		10 DAS	15 DAS	20 DAS
T1	17.0 (24.0)	2.33	2.33	1.93
T2	8.0 (15.7)	2.67	2.73	2.67
T3	10.0 (15.5)	3.00	2.43	2.10
T4	10.0 (14.6)	3.33	3.27	3.27
T5	6.0 (11.05)	2.67	3.53	3.33
T6	15.0 (19.7)	3.00	2.83	2.50
T7	32.0 (34.39)	2.67	1.87	1.53
T8	5.0 (12.74)	3.00	2.67	2.33
T9	22.0 (27.92)	1.33	1.27	1.00
T10	8.0 (13.77)	2.33	3.57	3.23
T11	20.0 (23.62)	2.33	3.37	3.03
T12	8.0 (16.07)	3.33	3.13	2.80
T13	9.0 (17.25)	2.33	2.53	2.20
T14	16.0 (23.06)	2.00	2.87	2.53
T15	59.7 (50.55)	0.00	0.00	0.00
T16	59.3 (50.36)	0.00	0.00	0.00
S.E(m)	4.86			
C.D. (p=0.05)	14.11			

Note: Values in the parenthesis are arc sign transformed values

Table-2 Plant height and number of leaves in finger millet as influenced by pre-emergence herbicide application under different soil moisture regimes

Treatments	Plant height (cm)		No. of leaves per plant	
	20 DAS	30 DAS	20 DAS	30 DAS
T1	4.72	8.00	4.87	8.00
T2	5.27	7.63	5.40	7.47
T3	4.77	8.06	5.27	8.33
T4	4.71	7.43	5.53	8.13
T5	4.62	8.41	5.27	8.53
T6	4.76	7.90	5.67	8.07
T7	4.76	7.63	5.20	8.80
T8	4.31	8.06	4.47	7.93
T9	4.75	7.57	5.33	8.80
T10	4.19	8.27	4.27	8.07
T11	5.02	8.46	4.93	7.47
T12	4.72	8.71	5.20	9.07
T13	4.37	8.00	4.67	7.60
T14	4.80	7.81	5.00	7.20
T15	5.36	8.27	5.73	8.73
T16	5.00	8.21	5.20	8.73
S.E(m)	0.299	0.43	0.324	0.571
C.D. (p=0.05)	NS	NS	NS	NS

The visual toxicity symptoms on finger millet crop were observed mainly in terms of poor germination and stunted growth only. The pre-emergence application of oxyflurofen (23.5 EC) @ 60 g a.i. /ha or butachlor (50 EC) @ 600 g a.i. /ha, irrespective of moisture regimes recorded higher visual toxicity ratings (1.33 to 3.33, 1.27 to 3.57 and 1.00 to3.33) as compared to hand weeding twice or unweeded control at 10, 15 and 20DAS, respectively. The toxicity effect of these two herbicides on finger millet crop might be due tonon selective for the crop as they are having graminicide effect during germination. The phytotoxicity rating is still higher at 15 and 20 DAS in both the herbicides with irrigation given after sowing of crop might be due to higher soil moisture which directly influence on herbicidal activity that to graminicidal effect during germination period. Similar phytotoxicity effect caused due to oxyflurofen application [1] in rice. On onion, similar results were noticed with respect to toxicity symptom of oxyflurofen within 15 days of application [2]. Although toxicity was observed during earlier period of growth in terms of germination failure and stunted growth but later recovered plants could be seen after one month after spray. Similar results were reported [2]. The toxicity and persistence of oxyflurofen in soils under different soil moisture regimes was positively correlated and it followed the order of 50 percent maximum water holding capacity >maximum water holding capacity > submergence in soils of Mandya [3]. Soil organic matter, clay content and soil moisture are the factors which influence the degradation of oxyflurofen in different soils. The growth attributes such as plant height and number of leaves per plant was recorded at both 20 and 30 DAS. The data indicates that both plant height and number of leaves per plant were found to be statistically nonsignificant at 20 and 30 DAS revealing that herbicide application might have no effect on later part of growth in finger millet.

Conclusion

From the study it can be concluded that pre-emergence application of oxyflurofen 23.5 EC @ 60 g a.i. /ha and butachlor 50 EC @ 600 g a.i. /ha followed by adequate soil moisture by irrigation or rainfall during germination period significantly lowered germination of direct seeded finger millet along with initial phytotoxicity symptoms such as stunted growth.

Application of research: 1, 2 sentences

Research Category: Crop Science

Abbreviations: DAS- days after sowing

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Study area / Sample Collection: Zonal Agricultural Research Station, V.C. Farm, Mandya

Cultivar / Variety name: Finger millet (*Eleusine Coracana* L. Gaertn)

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
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