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Consequence of Weed Management on Nutrient Uptake by Finger Millet in Transplanted Condition

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ABSTRACT: Finger millet is important rained crop having rich source of minerals and slow initial growth makes finger millets crop more prone to weed infestation which leads to high crop-weed competition. So weed management practices become important practice for nutrient uptake and yield of crop and this research was design on focusing weed management. Afield experiment was design at research farmland, Bihar Agricultural University, Sabour, Bhagalpur to know consequence of weed management in transplanted Finger millet. Experiment was design in randomized block design (RBD) with eleven treatment and three replication viz.T_1 (Weedy check) (control), T_2 (Hoeing at 20 and 40 DAT), T_3 (Pendimethalin @ 750 g a.i. ha^{-1} as pre-emergence, T_4 2, 4- D @ 750 g a.i. ha^{-1} as post-emergence), T_5 (Bispyribac sodium @ 20 g a.i. per ha as post-emergence), T_6 (Pendimethalin @ 750 g a.i. ha^{-1} as pre-emergence *fb*2, 4-D @ 750 g a.i. ha^{-1} as post-emergence), T_7 (Pendimethalin @750 g a.i. ha^{-1} as pre-emergence *fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-emergence), T_8 (Pretilachlor @1000 g a.i. per ha as pre-emergence), T_9 (Pretilachlor @1000 g a.i. ha^{-1} as pre-emergence *fb* 2, 4- D @ 750 g a.i. ha^{-1} as post-emergence), T_{10} (Pretilachlor @1000 g a.i. per ha as pre-emergence *fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post- emergence), T_{11} (as weed free). Among different management T_2 shows efficient weed management practice but in chemical management T_7 and T_{10} is effective in controlling weeds and lower uptake of nutrient by weed.

Keywords: Weed management, Finger millet, Nutrient uptake, Yield, Crop-weed competition.

INTRODUCTION

Finger millet is one of most important millets crop which is cultivated in rain fed condition in India but mostly grown in southern part of India. It is commonly known as Ragi or Madua. In India, Finger millet cultivation occupied 1.27 million hectares (mha) with the production of 2.61 million tones (MT) and the average productivity of 1.489 tonnes per ha (Prasannakumar *et al*., 2019). In Bihar, it grown in an area of 4211 ha with a production of 4184 tons at an average productivity of 994 kg per ha (Anonymous, 2017). Finger millets grain content high amount of amino acid, protein, dietary fiber and other minerals like Ca (Calcium), ranging from 162.0-358.0 mg/100 g as compared to other millet species (Manjula *et al.,* 2015), P (phosphorous) content in Finger millet ranging from 130.0-283.0 mg g^{-1} (Ramashia *et al*., 2018), Fe (iron) with a concentration of 3-20% (Shukla *et al.,* 2014) and magnesium involve in the reduction of high blood pressure, seriousness of asthma, regularity of migraines and the chance of heart attack (Prashantha *et al.,* 2014). Finger millet grains are gluten-free, non-acid-forming, and easy to digest with low glycemic index foods (Muthamilarasan *et al.,* 2016). Apart from human consumption, Finger millets straw is used as fodder purpose for cattle and the green straw is used in making silage, which is good in aroma. Now a day, Indian farmers are facing erratic rain, more heat, reduced water availability and increased malnutrition. Under such situation finger millet crop can withstand these challenges and produce multiple securities. Major constrain in production and productivity of Finger millets are ineffective irrigation, nutrient management, poor shallow and marginal soils under rainfed conditions, heavy weed infestation. Finger millets growth is slower during early growth stage which results in smothering effect due to heavy weed infestation and biotic stresses for finger millet production. Unchecked weed growth during crop period lower the grain yield ranging from 34 to 61% (Prasad *et al.,* 1991). Information about crop- weed competition for nutrient uptake will help to develop effective fertilizers management strategies.

Aggressiveness of weed for nutrient uptake will depend upon types of weed species, development stage, degree of infestation, degree of availability of nutrient in their habitat and types of agricultural practices (Rogoz and Niemiec, 2010). The critical period for crop-weed competition is 5 weeks after planting (Nanjappa *et al.,* 1980). To increased productivity and nutrient uptake of finger millets it is essential to reduced crop weed competition during early growth period. Manual weeding can result in lower weed infestation during early growth period but result in higher cost of cultivation so, for economically and effective weed management it is essential to use combination of herbicide and manual weeding. Hence, this research was planned with an objective to find out the most suitable weed management practice for control of weeds and competitiveness of weeds for nutrient uptake in transplanted ragi.

MATERIAL AND METHOD

During the Kharif season of 2019, a field experiment was conducted at the Research Farm, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, which is located in the Middle Gangetic plain region of Agro-climatic Zone III A in the Bhagalpur district at 25.50° North latitude and 87.190 East longitudes with an altitude of 52.75 metres above mean sea level in the Bhagalpur district. The experimental field's soil texture was sandy loam, with low accessible organic carbon (0.48 percent) and available nitrogen (215 kg/ha), but medium available phosphorus (23.5 kg/ha) and potassium (183.6 kg/ha) with a pH of 7.35.

Table 1: Treatment detail of the experiment.

Treatments	Treatments Detail
T_1	Weedy check (control)
T_2	Hoeing at 20 and 40 DAT
T_3	Pendimethalin @ 750 g a.i. ha^{-1} as pre-emergence
T_4	2, 4- D @ 750 g a.i. ha^{-1} as post-emergence
T_5	Bispyribac sodium @ 20 g a.i. ha^{-1} as post-emergence
T_6	Pendimethalin @ 750 g a.i. ha^{-1} as pre-emergence *fb*2, 4-D @ 750 g a.i. ha^{-1} as post- emergence
T_7	Pendimethalin @750 g a.i. ha^{-1} as pre-emergence *fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-emergence
T_8	Pretilachlor @1000 g a.i. ha^{-1} as pre-emergence
T_9	Pretilachlor @1000 g a.i. ha^{-1} as pre-emergence *fb* 2, 4- D @ 750 g a.i. ha^{-1}as post-emergence
T_{10}	Pretilachlor @1000 g a.i. ha^{-1} as pre-emergence*fb*Bispyribac sodium @ 20 g a.i. ha^{-1} as post- emergence
T_{11}	weed free

The experiment was set up in a randomised block design with three replications, containing eleven treatments (Table 1). The experiment was repeated three times using eleven different weed management strategies in a randomized block configuration. The GPU-64 variant was utilised in the experiment, with a 20 × 20 cm spacing. A suggested fertilizer dose (50:40:25 N: P_2O_5: K_2O Kg/ha) was evenly applied to each plot. The entire amount of phosphate, potassium, and one-third of the nitrogen dose was applied as a basal dose at the time of transplanting, and the remaining two-thirds of the nitrogen dose was applied in two equal splits at 20 and 50 DAT. Urea, SSP, and MOP are sources of nitrogen, phosphorous, and potassium. Three hills were chosen at random and marked in each net plot for write down observation without destructive sampling. On a 30-day interval, all observation data throughout crop growth was acquired from these tagged plants. Two hills were selected from each plot's border row for destructive sampling. Finger millet plant (grain + straw) samples were collected at harvest and weed samples at 60 DAT, and these samples were ground separately in a willey mill to pass through a 40-mesh sieve after sun drying and oven drying. Chemical analysis was performed on the ground material. The following formula was used to calculate nutrient uptake by plants and weeds:

Nutrient uptake (kg ha^{-1}) =

$$\frac{\text{Nutrient concentration (\%)}}{100} \times \text{Dry weight (kg ha}^{-1}\text{)}$$

The experiment data recorded for growth, yield attributes, weed population, were statically analyzed by the process of analysis of variance for randomized block design (RBD). For significant 'F' test, critical difference was reported at 5% probability level.

RESUTS AND DISCUSSION

Weed flora: Major weed species found in experimental plot are among grassy weeds *Cynodon dactylon, Digitariasan guinalis, Elusine indica, Echinochloa crus galli,* and *Panicum maxima*, *Cyperus* spp. among sedges, and among broad leaved weeds *Ageratum cinyzoides, Alternanthera triandra, Alternanthera sessilis, Celosia argentea, Commelina benghalensis, Melilotus indica* and *Phylanthus niruri.* Similar finding was reported earlier by Kumar *et al* (2007).

Nutrient uptake (kg ha^{-1}) by finger millet. Data on nutrient uptake by finger millet significantly varies due to different weed management practices are presented in Table 1.

Application of different herbicide caused significant improvement in nitrogen uptake by crop during year of investigation. Significantly maximum nutrient uptake (kg ha^{-1}) by finger millet was recorded with T_{11} (Weed free) which was on par with T_2 (Hoeing at 20 and 40 DAT), T_7 (Pendimethalin @750 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) and T_{10} (Pretilachlor @1000 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) treatment while lowest nutrient uptake (kg ha^{-1}) by finger millet was recorded with T_1 (Weedy check (Control)) treatment.

Similar observation was recorded by Singh *et al.*, (2010).

Nutrient uptake (kg ha^{-1}) by Weed. Among different weed control practices T_{11} (weed free) treatment did not show any nutrient uptake (kg ha^{-1}) by weed. But in other treatment minimum N, P, and K uptake (5.10, 1.08 and 6.96 kg ha^{-1}) was recorded with T_2 (Hoeing at 20 and 40 DAT) which was on par with T_7 (Pendimethalin @ 750 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) and T_{10} (Pretilachlor @ 1000 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) treatment. Maximum Nitrogen, Phosphorous and Potassium uptake (19.27, 4.15 and 30.01 kg ha^{-1}) was noticed with T_1 (Weedy check (Control)). Mishra *et al.,* (2012) and Singh *et al.,* (2005) observed similar result.

Table 2: Nutrient uptake (kg ha^{-1}) by Finger millets and weed as influenced by weed management practices.

Treatments	Nutrient uptake (kg ha^{-1}) by crop			Nutrient uptake (kg ha^{-1}) by weed		
	N	P	K	N	P	K
T_1	47.04	30.14	34.77	19.27	4.15	30.01
T_2	70.92	45.17	50.72	5.10	1.08	6.96
T_3	54.76	35.03	41.10	8.48	1.82	12.79
T_4	50.34	32.73	37.96	7.27	1.57	10.96
T_5	61.38	39.44	46.18	5.63	1.21	8.46
T_6	59.31	38.97	45.82	6.42	1.36	9.59
T_7	69.07	43.30	50.34	5.12	1.09	7.67
T_8	54.66	35.70	40.72	8.69	1.86	13.13
T_9	59.78	40.03	45.77	7.16	1.52	10.69
T_{10}	69.64	44.79	50.82	5.22	1.11	7.81
T_{11}	71.71	45.98	52.24	0.00	0.00	0.00
SEm ±	1.88	1.41	1.51	0.30	0.06	0.81
CD (P=0.05)	5.56	4.15	4.46	0.90	0.18	2.39

Yield and yield attributes. Yield is directly related to weed infestation. Weeds compete with crop for nutrient, light, space and other factor which directly influenced yield of crop. Among different weed management highest test weight (g), ear weight (g) and number of finger per ear was noticed in T_{11} (Weed free) and remain at par with all treatment except T_1 (Weedy check) but in case of number of finger per m^2 highest was recorded in T_{10} (Pretilachlor @1000 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em).

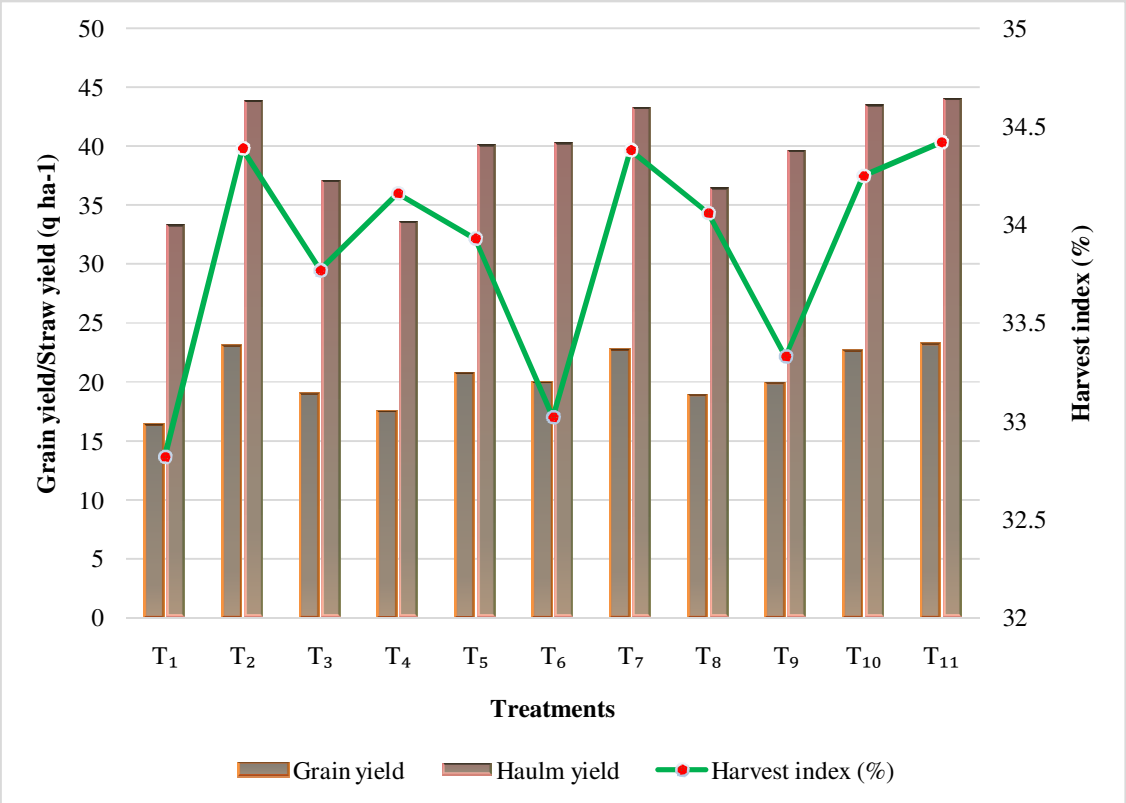

Fig. 1. Yield and yield attributes of Finger millets as influenced by weed management practices.

However, it was at par with T_5 (Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) and T_7 (Pendimethalin @750 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) and in finger length (cm) highest finger length (cm) was recorded in T_{11} (Weed free) but remain at par with T_2 (Hoeing at 20 and 40 DAT), T_6 (Pendimethalin @ 750 g a.i. ha^{-1} as pre-em*fb*2, 4-D @ 750 g a.i. ha^{-1} as post-em), T_7 (Pendimethalin @750 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em), T_8 (Pretilachlor @1000 g a.i. ha^{-1} as pre-em), T_9 (Pretilachlor @1000 g a.i. ha^{-1} as pre-em*fb* 2, 4-D @ 750 g a.i. ha^{-1}as post-em) and T_{10} (Pretilachlor @1000 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post- em). Similar result was reported by Ashrafi *et al.,* (2020). The results were close conformity with Pandey *et al.,* (2018), Kumar *et al.,* (2015) and Sunil *et al.,* (2010). As per graph highest grain and straw yield was noticed in (23.12 q ha^{-1}) and (44.01q ha^{-1}) was recorded with T_{11} (Weed free) which was significantly at par with T_2 (Hoeing at 20 and 40 DAT), T_7 (Pendimethalin @750 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) and T_{10} (Pretilachlor @1000 g a.i. ha^{-1} as pre-em*fb* Bispyribac sodium @ 20 g a.i. ha^{-1} as post-em) but significantly superior over rest of treatments. Lowest grain and straw yield (16.31 q ha^{-1}) and (33.31q ha^{-1}) was recorded with T_1 (Weedy check) treatment. The highest harvest index (34.42%) was found with T_{11} (weed free) treatment which remain at par with rest of treatment but significant over T_1 Weedy check (Control) treatment. Pandey *et al.,* (2018), Kumar *et al.* (2015), Prithvi *et al.,* (2015) and Naik *et al.,* (2001) reported similar result. The possible reason of getting above result is effective control of weeds in plot which result in better utilization of resource by crop and gives edge to crop in crop-weed competition and provide favorable condition for crop to produce growth characters and high LAI leads to higher dry matter production and finally higher yield and yield attributes.

CONCLUSION

Based on above facts and figure weed free treatment results in effective control of weeds but its result in highest cost of cultivation due more number of labour engaged in weeding so among different weed management practice the best treatment recoded during trail is sequential application of pendimethalin @750 g a.i. ha^{-1} / pretilachlor @1000 g a.i. ha^{-1} as pre-emergence *fb* bispyribac sodium @ 20 g a.i. ha^{-1} as post- emergence for higher yield, lower nutrient uptake by weeds and effective weed control in transplanted finger millet

FUTURE SCOPE

Further studies should carry out for one more year for suitable combination of herbicides for effective control of weeds and recommendation to finger millet grower. Experiments should be conducted in various agro-climatic conditions in Bihar to determine the best herbicide treatment combination for effective weed control.

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