Mysore J. Agric. Sci., 50 (2) : 301-304, 2015

Studies on Effect of Different Tillage and Nutrient Management Approaches on Growth, Yield and Weed Index in Finger millet

VEERESH HATTI, B. K. RAMACHANDRAPPA AND MUDALAGIRIYAPPA
Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru-650 065

ABSTRACT

A field experiment was carried out at AICRP on Dryland Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka during *kharif*, 2014 to study the effect of different tillage and nutrient management approaches on growth, yield and weed index in finger millet. The field experiment was laid out in split plot design with three main plots on different tillage treatments and five sub plots with different nutrient management practices. The main plot tillage treatments consisted of conventional tillage (2 ploughings + 1 harrowing + 2 intercultivations at 25 and 50 DAS), minimum tillage (1 ploughing + 1 harrowing + application of pre-emergence herbicide - isoproturon at 565 g a.i. ha^{-1}) - drill sown finger millet and zero tillage (glyphosate 41 SL at 10 ml lit^{-1} at 15 days before transplanting) with transplanted finger millet at 25 DAS. The sub plot nutrient management practices consisted of application of 100 % recommended NPK (50:40:25 kg NPK ha^{-1}), 100 per cent recommended NPK + 7.5 t FYM ha^{-1}, horsegram residue mulch + 100 per cent recommended NPK, horsegram residue mulch + 50 % recommended NPK + 25 per cent N through FYM + *Azotobacter* seed treatment and horsegram residue mulch + fertilizers based on soil test results. The results revealed that the significantly higher growth and yield parameters *i. e.,* leaf area index, total leaf area duration, number of tillers per plant at harvest and total dry matter production resulted in significantly higher grain and straw yield (3202 kg ha^{-1} and 4953 kg ha^{-1}, respectively) with lower weed index (10.26 %) in conventional tillage *i. e.,* 2 ploughings + 1 harrowing + 2 intercultivations at 25 and 50 DAS as compared to minimum tillage *i.e.,* 1 ploughing + 1 harrowing + application of pre emergence herbicide - isoproturon at 565 g a. i. ha^{-1} (2758 kg ha^{-1} and 4291 kg ha^{-1} and 22.70%, respectively) and zero tillage-transplanting *i. e.,* no tillage-glyphosate 41 SL at 10 ml lit^{-1} at 15 days before transplanting (2302 kg ha^{-1} and 3610 kg ha^{-1} and 35.49 %, respectively). Among nutrient management practices, application of 100 per cents NPK (50:40:25 kg NPK ha^{-1}) + 7.5 t FYM ha^{-1} recorded significantly higher grain and straw yield (3249 kg ha^{-1} and 5060 kg ha^{-1}, respectively) due to improved growth and yield attributes followed by other treatments.

THE challenge for agricultural scientists to increase food production to meet food security needs still persists even after 40 years of green revolution as population growth continues to increase in many developing countries. However, today such production increases must be accomplished sustainably, by minimizing negative environmental effects and, equally important, providing increased income to help improve the livelihoods of those employed in agricultural production. Adequate food production for ever-increasing global population can only be achieved through the implementation of sustainable production practices that minimize environmental degradation and preserve resources while maintaining high-yielding profitable systems.

Dryland farms are not only thirsty but also hungry for the nutrients and hence, the conservation of soil, water and other natural resources is a crucial factor for achieving sustainable production in rainfed farming. More dependent on high analysis straight fertilizers and less use of organics has resulted in imbalance in nutrients and excessive mining of native fertility causing multi-nutrient deficiencies (Yadav *et al.*, 2006). Widespread resource degradation problems under conventional system, and the need for reducing production costs, increasing profitability and making agriculture more competitive, have made the conservation issues more imperative. Globally innovations of conservation agriculture-based crop management technologies are said to be more efficient, use less inputs, improve production and income, and address the emerging problems (Gupta and Seth, 2007).

Minimizing the intensity of tillage is one of the major conservation agricultural practices which needs to be evaluated under various crops and cropping systems for Indian conditions. Finger millet (*Eleusine coracana*) is an important millet crop of southern Karnataka grown mostly under rainfed conditions with its well-known nutritional qualities made the crop very popular. The conservation tillage practices influence the crop productivity and weed emergence apart from conserving soil and water. Under conservation tillage practices, weeds are the major causes for yield reduction as these compete with the crop for nutrients, water, sunlight and space where use of herbicides to manage weeds forms an appropriate alternative strategy to manual weeding (Baskaran and Kavimani, 2014). With this background, the present experiment was conducted to study the impact of different tillage and nutrient management approaches on growth, yield and loss caused by weeds in finger millet in the Eastern Dry Zone of Karnataka.

A field experiment was conducted at AICRP on Dry Land Agriculture, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka during *Kharif* 2014 on red sandy clay loam soils and the location was at the Eastern Dry Zone of Karnataka at a latitude of $12^0$58' N and longitude of $75^0$35' E with an altitude of 930 m above mean sea level. The soil type of the experimental site was red sandy clay loam in texture, which are deep and possess good drainage with a pH-5.7, organic carbon content of 0.45%, available nitrogen-225 kg ha^{-1}, available phosphorus-50 kg ha^{-1} and available potassium-135 kg ha^{-1}. The field experiment was conducted using split plot design with three tillage treatments *i. e.*, T_1: Conventional tillage (2 ploughings + 1 harrowing + 2 intercultivations at 25 and 50 DAS) with drill sown finger millet, T_2: Minimum tillage (1 ploughing + 1 harrowing + application of pre emergence herbicide - isoproturon at 565 g a.i. ha^{-1}) - drill sown finger millet and T_3: Zero tillage (glyphosate 41 SL at 10 ml lit^{-1} at 15 days before transplanting) with transplanted finger millet at 25 DAS and five nutrient management practices in sub plots, N_1: 100 per cent recommended NPK (50:40:25 kg NPK / ha), N_2: 100 per cent recommended NPK + 7.5 t FYM ha^{-1}, N_3: Horsegram residue mulch + 100 per cent recommended NPK, N_4: Horsegram residue mulch + 50 per cent recommended NPK + 25 per cent N through FYM + *Azotobacter* seed treatment and N_5: Horsegram residue mulch + fertilizers based on soil test results (100 % P and 130 % N and K) with three replications to study the effect of different tillage and nutrient management practices on the productivity of finger millet. The pre emergence herbicide was applied with 750 litre water ha^{-1} using knapsack sprayer with WFN 78 nozzle and glyphosate was applied with 500 lit water ha^{-1} using knapsack sprayer with WFN 40 nozzle. The horsegram variety PHG-9 was broadcast at 50 kg ha^{-1} in May with pre-monsoon rains in respective treatment plots for mulching and harvested at 60 DAS and was mulched in between complete established finger millet crop rows. The ploughing was done using tractor and harrowing operations were done using bullock pairs as per the treatments in respective plots. The finger millet variety GPU-28 was sown / transplanted at a spacing of 30 × 10 cm with a seed rate of 10 kg ha^{-1} on 9^{th} August, 2014 and on the same day, the nursery beds were sown and seedlings were transplanted at 25 DAS in the main field. The seeds were treated with *Azotobacter* nitrogen fixing biofertilizer and while transplanting, the root dipping of seedlings was done as per the treatments. The FYM was applied two weeks before sowing and full dose of P and K and half dose of N was applied at the time of sowing and second half of nitrogen was applied after the second intercultivation. The experimental data on soil microbial biomass, yield and yield parameters were subjected to analysis by using Fisher's method of "Analysis of Variance" (ANOVA) as outlined by Panse and Sukhatme (1954). The levels of significance used in "F" and "t" test was at $P = 0.05$.

The major weed flora observed in the experimental field were *Borreria hispida, Portulaca oleraceae* among broad leaved weeds, *Eleusine indica*, *Digitaria* sp., *Cynodon dactylon*, among grasses and *Cyperus rotundus* among sedges. The different tillage and nutrient management practices significantly influenced the growth, yield and weed index of finger millet (Table 1). Among different tillage practices, the conventional tillage recorded significantly higher leaf area index at harvest (2.46) which has reflected in terms of higher total leaf area duration (200.52 days), number of tillers at harvest (6.18 $plant^{-1}$) have led to increased photosynthetic activity and resulted in more dry matter production

TABLE I

Growth, yield and weed index of finger millet as influenced by conservation tillage and nutrient management practices

Treatments	Leaf area index (LAI) at harvest	Total LAD (Days)	No. of tillers plant^{-1} at harvest	TDMP at harvest(g plant^{-1})	Grain yield(kg ha^{-1})	Straw yield(kg ha^{-1})	Weed index (%)
Tillage practices (T)							
T_1: Conventional tillage-Drill sowing	2.46	200.52	6.18	40.04	3202	4953	10.26
T_2: Minimum tillage-Drill sowing	2.14	174.13	5.33	34.49	2758	4291	22.70
T_3: Zero tillage-Transplanting	1.74	143.82	4.44	28.78	2302	3610	35.49
S.Em±	0.05	NA	0.13	0.87	76.97	137.96	NA
CD at 5%	0.18		0.52	3.40	302.23	541.69	
Nutrient management practices (N)							
N_1: 100 % recommended NPK (50:40:25 kg NPK ha^{-1})	1.91	156.00	4.79	31.01	2480	3853	30.49
N_2: 100% recommended NPK + 7.5 t FYM ha^{-1}	2.49	203.88	6.27	40.63	3249	5060	8.93
N_3: Horsegram residue mulch + 100 % recommended NPK	2.14	175.14	5.39	34.88	2790	4346	21.80
N_4: Horsegram residue mulch + 50 % recommended NPK + 25 % N through FYM + *Azotobacter* seed treatment	1.82	148.97	4.58	29.63	2370	3682	33.58
N_5: Horsegram residue mulch + Fertilizers based on soil test results	2.20	180.14	5.56	36.01	2880	4484	19.27
S.Em±	0.05	NA	0.12	0.79	63.92	102.66	NA
CD at 5%	0.14		0.35	2.30	186.57	299.64	
Interaction (TxN)							
N at same level of T							
S.Em±	0.08	NA	0.21	1.36	110.71	177.81	NA
CD at 5%	NS		NS	NS	NS	NS	
T at same or different level of N							
S.Em±	0.09	NA	0.23	1.49	125.42	210.54	NA
CD at 5%	NS		NS	NS	NS	NS	

Note: CD-Critical difference, NS-Non significant, NA-Not analysed, LAD-Leaf area duration, TDMP-Total dry matter production. The data on grain yield (3568 kg ha^{-1}) under weed free conditions for calculating weed index (WI) was taken from additionally maintained plots.

(40.04 g plant^{-1}) which has abled to produce significantly higher grain yield and straw yield (3202 kg ha^{-1} and 4953 kg ha^{-1}, respectively). This higher growth and yield in conventional tillage was attributed to lower weed growth due to deposition of surface situated weed seeds to deeper soil layer by soil inversion with tillage operations before sowing of finger millet which unable the weed seeds to germinate and followed by physical suppression of weeds by the intercultivations at 25 and 50 DAS during crop growth period as reflected by lower weed index (10.26 %) apart from creating favourable conditions *viz.*, soil aeration. The conventional tillage was followed by minimum tillage with 2758 kg ha^{-1} grain and 4291 kg ha^{-1} straw yield due to comparatively lesser weed control with pre emergence herbicide with higher weed index (22.70 %). Significantly lower growth and grain and straw yield were observed under zero tillage (2302 kg ha^{-1} and 3610 kg ha^{-1}, respectively) due to poor growth and yield parameters because of higher weed growth as a resultant of higher weed seeds deposition in the surface layer due to no soil inversion (Chauhan *et al.,* 2006) apart from poor root growth due to higher soil penetration resistance have all led to lower grain and straw yield with higher weed index (35.49 %). These results are in confirmatory with Manjith Kumar and Angadi (2014).

It can be concluded that among different nutrient management practices, application of 100 per cent NPK (50:40:25 kg NPK ha^{-1}) + 7.5 t FYM ha^{-1} recorded significantly higher leaf area index at harvest (2.49), total leaf area duration at harvest (203.88 days), number of tillers (6.27) and total dry matter production and accumulation in plants at harvest (40.63 g plant^{-1}) which reflected in significantly higher grain and straw yield (3249 kg ha^{-1} and 5060 kg ha^{-1}, respectively). Higher growth and yield was because of the release of nutrients based on crop demand and improvement in soil physico-chemical and biological properties have led to improved growth of the plants and dry matter production as a resultant of integrated nutrient management system as supported by Prasad *et al.* (2016). This treatment was followed by application of horsegram residue mulch + fertilizer application based on soil test results (100 % P and 130 % N and K) (2880 kg ha^{-1} and 4484 kg ha^{-1} grain and straw yield, respectively) which was on par with horsegram residue mulch + 100 per cent recommended NPK. Whereas, significantly lower grain yield was observed in horsegram residue mulch + 50 per cent recommended NPK + 25 per cent N through FYM + *Azotobacter* seed treatment (2370 kg ha^{-1} and 3682 kg ha^{-1} grain and straw yield, respectively). The interaction between tillage and nutrient management practices was found not significant. Thus, it is concluded that the conventional tillage is most efficient tillage system in finger millet for realizing higher yields and application of 100% recommended NPK + 7.5 t FYM ha^{-1} is the most reliable nutrient management system to avail higher yields.

References

BASKARAN, R. AND KAVIMANI, R., 2014, Productivity of sunflower as influenced by tillage and weed management. *Indian J. Weed Sci.*, **46**(2): 138-141.

CHAUHAN, B. S., GILL, G. AND PRESTON, C., 2006, Influence of tillage systems on vertical distribution, seedling recruitment and persistence of rigid rye grass seed bank. *Weed Sci.*, **54** : 669-676.

GUPTA, R. K. AND SETH, A., 2007, A review of resource conserving technologies for sustainable management of the rice-wheat cropping systems of the Indo-Gangetic Plains (IGP). *Crop Prot.,* **26**: 436-447.

MANJITH KUMAR, B. R. AND ANGADI, S. S., 2014, Effect of tillage, mulching and weed management on performance of maize (*Zea mays*) in Karnataka. *Indian J. Dryland Agril. Res. Dev.,* **29**(1) : 57-62.

PANSE, V. G. AND SUKHATME, P. V., 1954, Statistical Methods for Agricultural Workers. I.C.A.R., New Delhi. pp. 59.

PRASAD, J. N. V. S., SRINIVASA RAO, CH., SRINIVAS, K., NAGA JYOTHI, CH., VENKATESWARLU, B., RAMACHANDRAPPA, B. K., DHANAPAL, G. N., RAVICHANDRA, K. AND MISHRA, P. K., 2016, Effect of ten years of reduced tillage and recycling of organic matter on crop yields, soil organic carbon and its fractions in *Alfisols* of semi arid tropics of southern India. *Soil Tillage Res.,* **156** :131-139.

YADAV, S. S., TIKKOO, A. AND YADAV, J. S., 2006, Balanced nutrient management for improving yield and quality of pearl millet, clusterbean and Indian mustard. In: *Proceedings of the international symposium on balanced fertilization*, 22-25 November 2006, Punjab Agricultural University, Ludhiana, India. pp. 289-304.

(Received : May, 2016 **Accepted :** June, 2016**)**