www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(11): 1473-1476
© 2021 TPI
www.thepharmajournal.com
Received: 02-08-2021
Accepted: 09-10-2021

A Aliveni
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

B Venkateswarlu
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

M Sree Rekha
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

PRK Prasad
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

K Jayalalitha
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

Corresponding Author:
A Aliveni
Department of Agronomy, Agricultural College, Bapatla, Andhra Pradesh, India

Residual effect of nutrient management approaches in finger millet on growth and yield of *rabi* horsegram under finger millet: Horsegram cropping sequence

A Aliveni, B Venkateswarlu, M Sree Rekha, PRK Prasad and K Jayalalitha

Abstract
A Field experiment was conducted at Agricultural college farm, Bapatla during the *kharif* and *rabi* seasons of 2018-19 and 2019-20 to study the residual effect of nutrient management approaches in finger millet on growth and yield of succeeding horsegram crop under finger millet - horsegram system. The experimental design was split plot with three replications. The main-plot factor comprised of three crop geometries with different age of seedlings (30x10 cm with 30 days old seedlings, 30x30 cm with 15 days old seedlings and 45x45 cm with 15 days old seedlings) and seven nutrient management practices (S_0: absolute control, S_1: FYM @ 10 tonnes ha^{-1} + application of *dravajeevamrutham*, S_2: FYM @ 10 tonnes ha^{-1} + application of *dravajeevamrutham* along with wooden log treatment, S_3: FYM @ 10 tonnes ha^{-1} + 100% RDF, S_4: FYM @ 10 tonnes ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tonnes ha^{-1} + 125% RDF, S_6: FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment) in subplots were given to *kharif* finger millet. During succeeding *rabi* season on the same field horsegram was grown to study the residual impact. The application of FYM @ 10 tonnes ha^{-1} + 125% RDF along with or without wooden log treatment to finger millet reported the significant residual effect on growth, seed and haulm yields of succeeding horsegram crop.

Keywords: Finger millet-horsegram, cropping sequence, nutrient management, growth and yield

Introduction

Many cereal based intensive cropping systems are in vogue in different agroclimatic regions of the country. As growing of only cereals is not much remunerative in the present agricultural scenario to overcome the diverse demand of consumers and fast growing population. Planning intensive cultivation through the sequence cropping systems in a sustainable way will help in increasing the food grain production. Finger millet is a very compatible crop and can accommodate in any cropping system such as intercropping, sequential cropping, strip cropping, mixed cropping and crop rotation *etc* (Meena *et al*., 2017) [10]. Crop rotation is an effective tool for sustainable production with efficient utilization of crop input resources. Legumes with their ability to fix nitrogen very conveniently adapt to different cropping patterns and may offer opportunities to sustain increased productivity (Jeyabal and Kuppuswamy, 2001) [8]. Under such situations finger millet-legume rotation assume one of the important practices to achieve sustainability in crop production and thus finger millet-horsegram sequence can be one of the major finger millet based crop rotations for southern states of India. This crop sequence has the potential to provide secured income to the farmer, maintain the soil health besides sustain agricultural production. As the productivity of succeeding crops depend on preceding crops and their level of management, the residual effect of nutrients refers to the conservation over benefit of applied nutrients available to the succeeding crops. Greater proportion of residual fertilizer nitrogen was preserved in the upper 60 cm profile and a substantial amount of NO_3-N was found up to 180 cm of the soil profile (Subbaiah and Sachdev, 1983) [18]. Since many studies have revealed that only a fraction of applied phosphatic fertilizer is utilized by a single crop and considerable amount of nutrients are left over in soil (Goswami and Singh, 1976) [4], it was felt pertinent to design an experiment to know the residual effect of nutrient management approaches in finger millet on growth and yield of *rabi* horsegram under finger millet - horsegram cropping sequence.

Materials and Methods

The experiment was conducted at Agricultural college farm, Bapatla during the *kharif* seasons of 2018 and 2019. The soil of experimental site was sandy clay loam in texture with slightly alkaline reaction, low organic carbon content, low available nitrogen and medium in available phosphorous and potassium. The experiment was laid in split plot design with 21 treatments, replicated thrice. The treatments comprised of two factors, *viz*., crop geometries with different age of seedlings (M_1: 30x10 cm with 30 days old seedlings, M_2: 30x30 cm with 15 days old seedlings and M_3: 45x45 cm with 15 days old seedlings) and seven nutrient management practices (S_0: absolute control, S_1: FYM @ 10 tonnes ha^{-1}+ application of *dravajeevamrutham*, S_2: FYM @ 10 tonnes ha^{-1} + application of *dravajeevamrutham* along with wooden log treatment, S_3: FYM @ 10 tonnes ha^{-1} + 100% RDF, S_4: FYM @ 10 tonnes ha^{-1} + 100% RDF along with wooden log treatment, S_5: FYM @ 10 tonnes ha^{-1} + 125% RDF, S_6: FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment. The growth parameters were recorded at periodical intervals of 30, 60 DAS and at harvest from the randomly selected five plants in each treatment. Pooled data of the growth parameters was given here for comprehensive understanding. Seed and haulm yields of horsegram was calculated to kg ha^{-1}.

Results

The initial and final plant population of horsegram remained statistically unchanged without giving any definite trend due to the various crop geometries and nutrient management treatments given to preceding finger millet, showing that sowing of horsegram was done properly and uniformly using healthy and viable seeds to maintain good germination, emergence and crop stand per unit area. The present findings are in accordance with the study conducted by Sathyapriya *et al*. (2019) [16] who reported a non-significant effect of the residual altered crop geometry and integrated weed management methods of maize on germination of succeeding bengalgram. Integrated nutrient management did not change the plant population significantly. These findings are in line with the earlier findings of Harikesh *et al*. (2017) [6] and Roy (2018) [14].

The various crop geometries tried in the *kharif* finger millet failed to influence significantly the plant height of *rabi* horsegram. Plant height at all stages was significantly influenced by nutrient management practices. Significantly taller plants were observed with residual effect of 125% RDF+FYM @ 10 tonnes ha^{-1} with wooden log treatment (S_6) and significantly the lowest plant height was recorded with the absolute control. Better nutrient availability might have resulted in greater plant height. Similar findings were also reported by Seema *et al*. (2017) [17]. Balanced nutrient supply by combination of both organic and inorganic sources to previous crops left over higher soil nutrients after harvest of *kharif* crop might have resulted in increased plant length. Similar findings were also reported by Swain *et al*. (2019) [20] on horsegram under sweet corn based cropping system.

Dry matter accumulation of horsegram recorded periodically during 30, 60 DAS and at harvest (Table 1) was significantly influenced by nutrient management practices and not by the various crop geometries and their interaction. The dry matter production increased with advancement in age of the horsegram. The highest dry matter production of horsegram was observed with S_6 at all stages of the growth. All the treatments were significantly superior to absolute control which recorded the lowest dry matter production.

Enhanced dry matter production with nutrient application at higher levels could be attributed to significant improvement in growth parameters like plant stature and leaf area consequent to adequate supply of nutrients in maintaining higher auxin levels which had favorable effect on cell enlargement and cell division. Higher plant height and LAI resulted in more interception and utilization of radiant energy, leading to higher photosynthetic rate, which resulted in higher accumulation of dry matter. Enhanced dry matter with increase in nitrogen level was reported by Sudhakar (2011) [19] in rice. More nutrient availability under INM treatments resulted into increased conversion of carbohydrates into proteins which in turn elaborated into protoplasm and cell wall material that increased the size of the cell, which was expressed morphologically in terms of plant height, leaf area and finally higher dry matter production (Koireng *et al*., 2018) [9].

Leaf area index differed significantly due to nutrient management treatments and not by various crop geometries of preceding finger millet crop and their interaction. Leaf area index of horsegram was significantly higher when its preceding finger millet crop was applied with 125% RDF +FYM along with wooden log treatment (S_6) and it was on a par with S_5. The lowest leaf area index was observed with the absolute control. Increased supply of nutrients to meet the requirement and also due to more uptake with profuse root growth that might have resulted in larger leaves. Sudhakar (2011) [19] reported significant increase in LAI of succeeding maize due to increased nitrogen levels applied to preceding rice.

The yield of horsegram (Table 2) was un influenced by various crop geometries tried in the preceding finger millet crop. Similar findings were also reported by Patel (1994) [13]. The present findings are also supported by Sathyapriya *et al*. (2019) [16] who found non significant residual effect of altered crop geometry in maize on growth and yield of succeeding bengalgram.

The seed yield of horsegram was significantly influenced by the nutrient management treatments given to preceding finger millet crop. Significantly the highest seed yield of horsegram was recorded (924 kg ha^{-1}) when the preceding finger millet crop was applied with 125% RDF+FYM with wooden log treatment (S_6) which was found significantly superior to the rest of the treatments except the other integrated nutrient management practices with and without wooden log treatment (S_5, S_4 and S_3). Significantly the lowest grain yield of horsegram was recorded with the absolute control (644 kg ha^{-1}).

Horsegram being a leguminous crop and also having deep root system was able to meet a part of its requirement by way of nitrogen fixation and could be able to use the nutrients available from the deeper layers of soil resulting in appreciable yields in certain residual treatments. Similar results were also supported by Basavarajappa *et al*. (2003) [2] in his study on performance of horsegram and castor crops on residual soil fertility of *kharif* foxtail millet.

FYM have not been fully utilized by the finger millet crop in first crop season and notably benefitted the succeeding horsegram crop. The present results are in accordance with the earlier findings of Koireng *et al*. (2018) [9]. The increased horsegram seed yield might be due to addition of FYM to preceding finger millet resulting in improvement in soil structure which reduced the soil crust and serves as a source of energy for soil microflora that resulted in better root nodulation and nitrogen fixation. The persistent material in organic manures (FYM) requires more time for its decomposition, hence, about 25 to 33% of nitrogen and small fraction of phosphorus and potassium in FYM may be available to preceding finger millet and rest to succeeding horsegram crop (Inoko, 1984) [7] which sustain the productivity. Similar results were also reported by Gawai and Pawar (2006) [3] in sorghum-chickpea, Gudadhe (2008) [5] in cotton-chickpea, Nawale *et al*. (2009) [12] in sorghum-chickpea and Saha *et al*. (2010) [15] in maize-mustard cropping sequence.

The data revealed that there was a significant difference among the nutrient management treatments but not by the crop geometries regarding haulm yield. Significantly higher haulm yield (2197 kg ha^{-1}) was recorded when the preceding finger millet was applied with 125% RDF+FYM with wooden log treatment (S_6) treatment. However, S_6 was statistically on a par with all the integrated nutrient management practices. The absolute control alone registered significantly the lowest haulm yield (1539 kg ha^{-1}).

The increased haulm yield with increasing nutrient levels applied to preceding finger millet might be attributed to significant increase in plant height accompanied by a larger leaf area. Both these beneficial effects were reflected in higher dry matter accumulation, finally resulting in higher haulm yield. These results are in accordance with the earlier findings of Sudhakar (2011) [19]. The favorable performance of residual effect of organics and in combination with inorganic fertilizers might be due to prolonged availability of nutrients in such treatments. The poor performance of horsegram under absolute control might be due to the fact that the plants could not get the required quantity of nutrients matching its demand. The present findings are in accordance with Mohanty *et al*. (2014) [11] who conducted earlier a study in rice-greengram sequence.

Harvest index (%) of horsegram was not influenced significantly by crop geometries and nutrient treatments applied to preceding finger millet. Their interaction was also found non-significant. In the current study the treatments imposed to preceding finger millet crop could not raise to influence significantly the harvest index of the succeeding horsegram as all the treatments could equally influence the character under study. Similar non significant influence of the treatments given to preceding crop on harvest index of the succeeding crop was also reported by Arunakumari (2018) [1] in rice-sorghum sequence.

Table 1: Growth parameters of *rabi* horsegram as influenced by *kharif* finger millet crop geometry and nutrient management practices (pooled data)

Treatments	Plant height (cm)			Dry matter production (kg ha^{-1})			Leaf area index		
	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
Crop geometry									
M_1- 30×10cm with 30 days old seedlings	14.8	26.9	57.6	1038.7	2030.6	2998.2	1.92	3.56	3.22
M_2- 30×30cm with 15 days old seedlings	14.1	25.6	56.4	1006.8	1986.7	2864.7	1.83	3.45	3.19
M_3- 45×45cm with 15 days old seedlings	13.1	24.0	57.3	984.6	1954.7	2773.6	1.79	3.29	2.92
S.Em±	0.49	1.05	0.83	18.94	54.98	69.92	0.04	0.07	0.11
CD (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	16.16	18.88	6.65	8.59	12.66	11.13	8.84	9.68	16.29
Nutrient management									
S_0-Absolute control	10.5	18.0	49.4	911.1	1547.6	2279.4	1.08	1.93	1.71
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	12.6	23.0	54.4	988.3	1757.2	2560.0	1.43	2.67	2.36
S_2- S_1+ passing wooden log	12.9	23.6	56.0	994.0	1805.5	2654.2	1.59	2.84	2.55
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	14.7	26.2	57.8	1028.3	2054.3	2959.4	1.90	3.52	3.22
S_4- S_3+ passing wooden log	15.0	27.2	59.6	1041.7	2111.7	3123.5	2.07	3.93	3.55
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	15.6	29.6	60.3	1046.5	2290.4	3260.5	2.33	4.36	4.09
S_6- S_5+ passing wooden log	16.7	30.9	62.1	1060.2	2367.9	3315.0	2.54	4.79	4.27
S.Em±	0.46	1.47	1.18	24.04	70.37	90.19	0.08	0.16	0.15
CD (p = 0.05)	1.3	4.2	3.4	68.9	201.8	258.7	0.23	0.46	0.43
CV (%)	9.90	17.26	6.20	7.14	10.61	9.40	13.03	14.11	14.62
Interaction									
M x S	NS	NS	NS	NS	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Plant population, yield and harvest index of *rabi* horsegram as influenced by *kharif* finger millet crop geometry and nutrient management practices (pooled data)

Treatments	Population		Seed yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest index (%)
	Initial	Final			
Crop geometry					
M_1- 30×10cm with 30 days old seedlings	30.64	30.05	849	2015	29.67
M_2- 30×30cm with 15 days old seedlings	30.48	30.04	809	1929	29.69
M_3- 45×45cm with 15 days old seedlings	30.83	30.18	782	1863	29.85
S.Em±	0.56	0.58	21.06	52.87	0.78
CD (p = 0.05)	NS	NS	NS	NS	NS
CV (%)	8.44	8.85	11.87	12.52	12.01
Nutrient management					
S_0-Absolute control	29.89	29.39	644	1539	29.56
S_1- FYM @ 10 tonnes ha^{-1} + *dravajeevamrutham*	30.55	29.76	732	1757	29.86

S_2- S_1+ passing wooden log	31.22	30.78	752	1816	29.59
S_3- FYM @ 10 tonnes ha^{-1} + 100% RDF	30.74	30.14	839	1999	29.46
S_4- S_3+ passing wooden log	30.59	30.09	886	2078	30.06
S_5- FYM @ 10 tonnes ha^{-1} + 125% RDF	30.91	30.31	916	2165	29.85
S_6- S_5+ passing wooden log	30.65	30.15	924	2197	29.76
S.Em±	0.52	0.52	29.96	69.53	0.84
CD (p = 0.05)	NS	NS	86	199	NS
CV (%)	5.09	5.18	11.05	10.77	8.50
Interaction					
M x S	NS	NS	NS	NS	NS
S x M	NS	NS	NS	NS	NS

Conclusion

After 2 years of research and considering various growth attributes and yield of rabi horsegram it could be concluded that integrated application of FYM @ 10 tonnes ha^{-1} + 125% RDF along with wooden log treatment increased growth parameters and yield of *rabi* horsegram compared to rest of treatments. Though growth and yield was not significant due to various crop geometries.

References

1. Arunakumari H. Phosphorus management in rice-sorghum sequence. Ph.D Thesis, Acharya N.G. Ranga Agricultural University, Guntur 2018.
2. Basavarajappa R, Prabhakar AS, Halikatti SI. Performance of horsegram and castor crops on residual soil fertility of kharif foxtail millet under shallow alfisols. Karnataka Journal of Agricultural Sciences 2003;16(1):116-120.
3. Gawai PP, Pawar VS. Integrated nutrient management in sorghum (*Sorghum bicolor*)-chickpea (*Cicer arietinum*) cropping sequence under irrigated conditions. Indian Journal of Agronomy 2006;51(1):17-20.
4. Goswami NN, Singh M. Management of fertilizer phosphorus in cropping system. Fertilizer News 1976;21(9):56-59.
5. Gudadhe NN. Effect of integrated nutrient management system in cotton-chickpea cropping sequence under irrigated conditions. Ph.D Thesis, MPKV, Rahuri 2008.
6. Harikesh, Akhtar Ali, Ghanshyam Singh, Sanjay Kumar, Shivam, Ravi Pratap Yadav, Ankit Tiwari *et al*. Effect of integrated nutrient management and plant geometry on soil properties and availability of nutrients under SRI technique of rice. Journal of Pharmacognosy and Phytochemistry 2017;6(5):86-89.
7. Inoko A. Compost as sources of plant nutrients. In: Organic matter and rice. IRRI, Los Banos, Philippines 1984, 137-145.
8. Jeyabal A, Kuppuswamy G. Recycling of organic wastes for the production of vermicompost and its response in rice-legume cropping system and soil fertility. European Journal of Agronomy 2001;15:153-170.
9. Koireng RJ, Anal PSR, Chanu TM, Devi Kh P. Residual effects of organic manure and micro nutrients on growth and yield parameters of greengram (*Vigna radiata*) in potato-greengram sequence. Indian Journal of Agricultural Research 2018;52(3):333-335.
10. Meena DS, Gautam Ch, Patidar OP, Ranvir Singh, Meena HM, Vishwajith *et al*. Management of finger millet based cropping systems for sustainable production. International Journal of Current Microbiology and Applied Sciences 2017;6(3):676-686.
11. Mohanty TR, Roul PK, Maity SK. Energetics of greengram (*Vigna radiata* L.) production as affected by residual effect of rice establishment methods and nutrient management practices in rice-greengram cropping system. Journal of Agriculture and Veterinary Science 2014;7(7):51-54.
12. Nawale SS, Pawar AD, Lambade BM, Ugale NS. Yield maximization of chickpea through INM applied to sorghum-chickpea cropping sequence under irrigated condition. Legume Research 2009;32(4):282-285.
13. Patel GK. Effect of spacings and varieties on yield and quality of Bidi tobacco and their influence on succeeding summer groundnut. M.Sc Thesis, Gujarat Agricultural University, Anand 1994.
14. Roy AK. Performance of finger millet (*Eleusine coracana* L. Gaertn.) under integrated nutrient management practices. M. Sc Thesis, Birsa Agricultural University, Kanke, Ranchi 2018.
15. Saha R, Mishra VK, Majumdar B, Laxminarayana K, Ghosh PK. Effect of integrated nutrient management on soil physical properties and crop productivity under a maize (*Zea mays*)-mustard (*Brassica campestris*) cropping sequence in Acidic Soils of Northeast India. Communications in Soil Science and Plant Analysis 2010;41(18):2187-2200.
16. Sathyapriya KC, Chinnusamy P, Murali A, Sritharan N. Effect of altered crop geometry and integrated weed management methods on productivity and profitability of irrigated maize and its residue effect on succeeding bengalgram. Journal of Pharmacognosy and Phytochemistry 2019;8(3):654-659.
17. Seema M, Nemade RB, Ghorade, Mohod NB. Integrated nutrient management (INM) in sorghum-chickpea cropping system under unirrigated conditions. International Journal of Current Microbiology and Applied Sciences 2017;6(2):379-385.
18. Subbaiah BV, Sachdev. A rapid procedure for the determination of available nitrogen in soils. Current Sciences 1983;25:259-260.
19. Sudhakar C. Integrated nutrient management in rice-maize cropping system. Ph.D Thesis, Acharya N.G. Ranga Agricultural University Rajendranagar, Hyderabad 2011.
20. Swain B, Garnayak LM, Naik P. Effect of crop combinations and nutrient management practices on the growth parameters, yield attributes and yield of horsegram under sweet corn based cropping systems in rainfed upland. International Journal of Chemical Studies 2019;7(3):3869-3874.