The Pharma Innovation Journal 2023; 12(11): 2231-2233

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(11): 2231-2233

www.thepharmajournal.com
Received: 10-08-2023
Accepted: 14-09-2023

VD Patel
Ph.D Student, Department of Agronomy, N M College of Agriculture, NAU, Navsari, Gujarat, India

VP Usadadiya
Professor, Department of Agronomy, N M College of Agriculture, NAU, Navsari, Gujarat, India

AP Patel
Associate Professor, Department of Agronomy, College of Agriculture, NAU, Waghai, Gujarat, India

VT Parmar
Ph.D student, Department of Agronomy, N M College of Agriculture, NAU, Navsari, Gujarat, India

Corresponding Author:
VD Patel
Ph.D Student, Department of Agronomy, N M College of Agriculture, NAU, Navsari, Gujarat, India

Residual effect of INM in finger millet on growth, yield and economics of chickpea under finger millet-chickpea cropping sequence

VD Patel, VP Usadadiya, AP Patel and VT Parmar

Abstract
A field experiment was carried out during *rabi* season of 2020-21 and 2021-22 at the Rajendrapur Farm, Hill Millet Research Station, NAU, Waghai (Dangs), Gujarat to find out residual effect of INM in finger millet on growth, yield and economics of chickpea under finger millet-chickpea cropping sequence. The treatments consisted of different integrated nutrient management *viz*., T_1: 100% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_2:100% RDF + NPK bio-consortium (2 lit/ha root dipping at TP), T_3: 100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage, T_4:75% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_5:75% RDF + NPK bio-consortium (2 lit/ha root dipping at TP), T_6:75% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage, T_7:50% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_8:50% RDF + NPK bio-consortium (2 lit/ha root dipping at TP) and T_9:50% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage to finger millet in *kharif* season as main plot treatments replicated four times in randomized block design. In *rabi* season each main plot treatment was split into two sub plot treatments with two levels of recommended dose of fertilizers *viz*., F_1-100% RDF and F_2 -50% RDF to chickpea resulting in eighteen treatment combinations. The treatment 100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage applied to finger millet recorded the significantly higher residual effect on growth, yields and economics of succeeding chickpea crop followed by treatments 100% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), 100% RDF + NPK bio-consortium (2 lit/ha root dipping at TP) and 75% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage.

Keywords: Finger millet-chickpea, cropping sequence, banana pseudo stem sap, bio-fertilizer, NPK bio-consortium

1. Introduction
Several cereal based cropping sequence are under practice in the country according to agro-climatic region. Under rainfed condition, particularly in hilly area of South Gujarat, finger millet-chickpea cropping sequence is mostly followed. Presently the trend of production of finger millet- chickpea cropping system in the state is constant or marginal decline in production. Also intensive cropping cultivation of high yielding varieties, crop residue burning and indiscriminate use of chemical fertilizers have resulted into depletion of nutrients, soil organic carbon and deterioration of soil physical conditions (Srivastava, 1998) [13]. Therefore, there is a need to manage the long term soil productivity through integrated use of both inorganic and organic sources of nutrients. The organic sources of nutrients intending farm yard manure, bio fertilizer have potential for increase soil organic matter and also reduce use of chemical fertilizers. Pulses are the economical source of dietary protein; valuable for animal feed and also plays a key role in improving and sustaining soil productivity on account of biological nitrogen fixation and addition of high amount of organic matter. Pulses are integral part of the cropping system because these crops fit well in the crop rotation and crop sequence and are most suited diversifying crops in cropping systems. Among the grain legumes, chickpea (*Cicer arietinum* L.) commonly known as Bengal gram and locally known as Chana is an important and unique food legume, because of its use in the variety of food products like snacks, sweets *etc*. condiments and vegetables are prepare from its world-wide. It is also consume in the form of processed whole seed (boiled, rosted, parched, fried, steamed, sprouted *etc*.) or as dal flour (Besan). Chickpea is a good source of protein (18 to 22%), carbohydrate (52 to 70%), fat (4 to 10%), minerals and vitamins. It is also an excellent animal feed; its stover has good forage value. In India, chickpea are grown in an area of 10.56 million hectares with total production of 11.23 million tonnes with productivity of 1063 kg/ha.

While in Gujarat, chickpea is grown in an area of 0.29 million hectares producing 0.37 million tonnes with the productivity of 1253 kg/ha (Anon., 2018) [1]. Which is high compared to national average productivity. Chickpea play a significant role in improving soil fertility by fixing the atmospheric nitrogen in to the soil. Chickpea meets 80% of its nitrogen fixation and can fix up nitrogen from air.

2. Materials and Methods

The field experiment was conducted at Rajendrapur Farm, Hill Millet Research Station, NAU, Waghai (Dangs) during *rabi* season of 2020-21 and 2021-22 to study the residual effect of integrated nutrient management in succeeding chickpea crop under finger millet-chickpea cropping sequence. The soil of the experimental site had a clayey texture, medium in organic carbon (0.60%), available nitrogen (272.80 kg/ha) and available phosphorus (29.84 kg/ha), whereas high in available potassium (367.50 kg/ha). The experiment comprising integrated nutrient management treatments *viz*., T_1:100% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_2:100% RDF + NPK bio-consortium (2 lit/ha root dipping at TP), T_3:100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage, T_4:75% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_5:75% RDF + NPK bioconsortium (2 lit/ha root dipping at TP), T_6:75% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage, T_7:50% RDF + *Azospirillum* + PSB (2 lit/ha root dipping at TP), T_8:50% RDF + NPK bio-consortium (2 lit/ha root dipping at TP) and T_9:50% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage applied to finger millet in *kharif* season as main plots treatment replicated four times in randomized block design. The required quantities of organics, Bio-fertilizers and NPK Bio-consortium were calculated and applied to the finger millet at the transplanting of seedling in accordance with the treatments. Banana pseudo stem sap was sprayed at the time of tillering and panicle initiation stages. FYM @ 5 t/ha was applied as common dose at the time of field preparation. The fertilizers were applied to finger millet as per treatments. The 50% dose of nitrogen in the form of Urea while full dose of phosphorus were applied in the form of Single super phosphate at the time of TP and remaining half dose of nitrogen was top dressed as Urea as per treatments. After the harvesting of finger millet crop the chickpea was sown as succeeding crop on 12th November 2020 and 20th December 2021. During *rabi* season each main plot treatment was split into two sub-plot treatments with two levels of recommended dose of fertilizer *viz.*, F_1 -100% RDF (20-40-00, N-P_2O_5-K_2O) and F_2-50% RDF (10-20-00, N-P_2O_5-K_2O kg/ha) to chickpea resulting in eighteen treatment combinations replicated four times in split plot design.

3. Results and Discussion

In order to quantify the response observed due to integrated nutrient management to the preceding *kharif* finger millet in Table-1 revealed that, plant height at harvest recorded significantly higher with treatment T_3, but it was remained at par with treatments T_1, T_2 and T_6. Significantly higher number of branches per plant at harvest was recorded under the treatment T_3, but it remained at par with treatments T_1, T_2 and T_6, during both the years and in pooled results, respectively. Significantly higher number of pod per plant was recorded with the treatment T_3, but it remained at par with treatments T_1, T_2 and T_6 during both the years and in pooled results, respectively. The addition of organic manures to preceding crop showed the positive impact on all the growth contributing characters during second year of experimentation than first year. This delayed impact can be attributed to the built up of residual effect on soil fertility after addition of organic manures for continuously two seasons. This might be due to the organic manure applied to preceding crop which might have helped to increase the microbial population in the rhizosphere. Also, more absorption of nutrients led to more assimilation in the fruiting parts which ultimately enhance the development of yield contributing characters. The beneficial residual effect of addition of organic product and inorganic fertilizers under cropping sequence on growth attributes reported by Imade (2014) [5], Sohu *et al*. (2015) [11], Mansri (2016) [7] and Nalini *et al*. (2020) [8].

Table 1: Residual effect of nutrient management in finger millet on growth and yield attributes of chickpea (Average of two year)

Treatments	Plant height at harvest			Branches per plant at harvest			Pod per plant		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Main plot (Applied to finger millet)									
T_1	39.24	40.07	39.65	10.50	11.22	10.86	33.57	33.80	33.68
T_2	38.73	39.73	39.23	10.27	11.10	10.68	32.97	33.30	33.13
T_3	39.77	40.60	40.18	10.60	11.42	11.01	33.97	34.23	34.10
T_4	36.00	36.76	36.38	9.60	10.26	9.93	30.00	30.63	30.32
T_5	35.60	36.45	36.03	9.50	10.18	9.84	29.83	30.30	30.07
T_6	38.10	38.91	38.51	10.17	10.86	10.51	32.40	32.97	32.68
T_7	34.60	35.51	35.05	9.27	9.90	9.58	28.87	29.23	29.05
T_8	33.87	34.87	34.37	9.03	9.65	9.34	28.10	28.50	28.30
T_9	35.13	36.08	35.61	9.33	9.97	9.65	29.40	29.77	29.58
S.Em±	1.25	1.34	0.91	0.27	0.40	0.24	1.28	1.05	0.83
CD (P=0.05)	3.73	4.01	2.63	0.81	1.21	0.70	3.85	3.16	2.39
CV (%)	9.58	10.04	9.82	7.79	10.84	9.54	11.70	9.48	10.63
Sub-plot (Applied to chickpea)									
F_1	39.07	39.95	39.51	10.36	11.09	10.73	33.26	33.70	33.48
F_2	34.50	35.38	34.94	9.25	9.93	9.59	28.76	29.13	28.95
S.Em ±	0.60	0.70	0.46	0.11	0.16	0.10	0.46	0.45	0.32
CD (P=0.05)	1.77	2.09	1.32	0.32	0.47	0.27	1.36	1.33	0.92
Interaction (T x F)									
S.Em ±	1.79	2.11	1.38	0.32	0.47	0.29	1.37	1.34	0.96
CD (P=0.05)	5.32	6.26	3.97	0.95	1.40	0.82	NS	NS	NS
CV (%)	9.73	11.19	10.50	6.54	8.99	7.95	8.84	8.56	8.70

Results furnished in Table 2 showed that 100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage (T_3) produced significantly higher seed and stover yields, but it remained at par with treatments T_1, T_2 and T_6. The better development of yield attributes may be an outcome of enhanced availability of nutrients to the chickpea crop from its own nutrient pool as well as the residual effect of the INM treatments in preceding crop. More absorption of nutrients led to more assimilation in the fruiting parts which ultimately enhance the development of yield contributing characters and also seed and stover yield. Similar result was reported by Singh *et al*. (2014) [10], Elamin *et al*. (2015) [2], Krishnaprabu (2016) [6], Nemade *et al*. (2017) [9] and Sonboir *et al*. (2020) [12].

The data of economics, consisting of the cost of cultivation, gross realizations and net returns as well as B: C ratio influenced by different treatments is furnished in Table 2. The results showed that gross realizations, net returns and BCR were obtain higher under treatment of 100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage (T_3) followed by treatments 100% RDF + *Azospirillum* + PSB (T_1) and 100% RDF+ NPK bio-consortium (T_2). However, the lowest values of Gross realizations, Net returns and Benefit: Cost ratio were recorded under the treatment of 50% RDF + NPK bio-consortium (T_8). These findings corroborate with the results of Gawai and Pawar (2006) [3], Gudadhe *et al*. (2011) [4], Imade (2014) [5] and Mansuri (2016) [7].

Table 2: Residual effect of nutrient management in finger millet on yields and economics of chickpea. (Average of two year)

Treatments	Yield (kg/ha)		Cost of cultivation (₹/ha)			Gross realizations (₹/ha)	Net returns (₹/ha)	Benefit: Cost ratio
	Seed	Stover	Fixed	Variable	Total			
Main plot (Applied to finger millet)								
T_1	1897	3556	42261	1654	43915	124477	80562	2.83
T_2	1863	3479	42261	1654	43915	122216	78301	2.78
T_3	1947	3609	42261	1654	43915	127662	83747	2.91
T_4	1701	3059	42261	1654	43915	111218	67303	2.53
T_5	1685	2992	42261	1654	43915	110052	66137	2.51
T_6	1829	3362	42261	1654	43915	119842	75928	2.73
T_7	1624	2855	42261	1654	43915	105989	62075	2.41
T_8	1577	2747	42261	1654	43915	102848	58933	2.34
T_9	1657	2941	42261	1654	43915	108219	64304	2.46
Sub-plot (Applied to chickpea)								
F_1	1889	3517	42261	2205	44466	123870	79404	2.79
F_2	1618	2839	42261	1102	43363	105579	62216	2.43

4. Conclusion

Two years of experimental results led to concluded that finger millet crop should be fertilized with 100% RDF + Banana pseudo stem sap 1% at tillering and panicle initiation stage reported beneficial residual effect on growth, yields and economics of succeeding chickpea crop in finger millet-chickpea cropping sequence in hilly area.

5. References

1. Anonymous. Agricultural statistics at a glance, Ministry of Agriculture & Farmers' Welfare, Directorate of Economics & Statistics, DAC&FW, New Delhi; c2018.
2. Elamin AY, Madhvi K. Residual effect of integrated nutrient management on growth and yield parameters of *rabi* chickpea (*Cicer arietinum* L.) under cropping system. American Journal of Scientific and Industrial Research. 2015;6(5):103-109.
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. Gudadhe NN, Khang VT, Thete NM, Lambade BM, Jibhkate SB. Studies on organic and inorganic sources of nutrient application in cotton-chickpea cropping sequence. Omon Rice. 2011;18:121-128.
5. Imade SR. Effect of integrated nitrogen management in rice-green gram cropping sequence under south Gujarat condition. Ph.D. thesis submitted to Navsari Agricultural University, Navsari (Gujarat); c2014.
6. Krishnaprabu S. Sustaining productivity of sorghum-chickpea cropping system in integrated nutrient management. Journal of Emerging Technologies and Innovative Research. 2016;3(1):867-874.
7. Mansuri RN. Effect of integrated nutrient management in rice-chickpea cropping sequence under south Gujarat condition. Ph.D. Thesis submitted to Navsari Agricultural University, Navsari (Gujarat); c2016.
8. Nalini N, Vani KP, Suneetha Devi KB, Surendra BP. Residual effect of integrated nutrient management, dates of sowing and fertilizer doses on growth and yield parameters of *Rabi* Bengal gram and French bean under pearl millet based cropping sequence. Journal of Pharmacognosy and Phytochemistry. 2020;9(1):2241-2244.
9. Nemade SM, Ghorade RB, 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.
10. Singh DK, Gupta S, Dubey AK, Pandey PC. Harnessing cosmic energy to enhance the productivity of organic basmati rice-based cropping system. Green Farming. 2014;5(5):725-729.
11. Sohu I, Gandahi AW, Bhutto GR, Sarki MS, Gandahi R. Growth and yield maximization of chickpea (*Cicer arietinum* L.) through integrated nutrient management applied to rice-chickpea cropping system. Sharad Journal of Agriculture. 2015;31(2):131-138.
12. Sonboir HL, Sharma S, Mahenderkumar R, Basant Kumar Sahu. Influence of establishment methods and nutrient management on productivity of *kharif* rice (*Oryza sativa* L.) and their residual effect on succeeding chickpea (*Cicer arietinum* L.) crop. International Journal of Current Microbiology and Applied Sciences. 2020;9(4):733-742.
13. Srivastava OP. Integrated nutrient management for sustained fertility of soil. Indian Journal of Agricultural Chemistry. 1998;31:1-12.