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Research Article

Effect of Integrated Nutrient Management on Growth and Yield Parameters of *Kharif* Little Millet under Little Millet-Green Gram Cropping Sequence

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ABSTRACT

A field experiment was conducted during kharif and rabi seasons of 2016-17 and 2017-18 at Rajendrapur Farm, Krishi Vigyan Kendra, Navsari Agricultural University, Waghai (Dist. Dangs), Gujarat to study the residual effect of integrated nutrient management in little millet on production potential of succeeding green gram crop under little millet-green gram cropping system. The treatment consisted of integrated nutrient management viz. T_1 – 100% RDF, T_2 – 50% RDN through chemical fertilizer + 50% RDN through bio compost, T_3 – 50% RDN through chemical fertilizer + 50% RDN through vermin compost, T_4 – 75% RDN through chemical fertilizer + 25% RDN through bio compost, T_5 – 75% RDN through chemical fertilizer + 25% RDN through vermin compost and Azotobacter and PSB applied each 2 lit/ha for all treatment to little millet in kharif season as main plot treatments replicated four times in randomized block design. During rabi season each main plot treatment was split into four sub plot treatments with four levels of recommended dose of fertilizers viz. S_1 -control, S_2 - 50% RDF and S_3 – 75% RDF, and S_4 – 100% RDF to green gram resulting in twenty treatment combinations replicated four times in split plot design. The experiment was conducted on same site without changing the randomization of the treatment for the successive year to assess the residual effects. The residual effect of 50% RDN through chemical fertilizer + 50% RDN through vermicompost to kharif little millet reported the significant effect on growth, yield attributes, seed and stover yields of succeeding green gram followed by 50% RDN through chemical fertilizer + 50% RDN through bio compost. Thus, application of RDF i.e. 40 kg nitrogen (75% RDN through chemical fertilizer + 25% RDN through vermin compost) along with recommended dose of 20 kg P_2O_5 reported promising effect on growth, yield and yield attributing characters of little millet in little millet-green gram cropping sequence under South Gujarat condition.

Key words: *Little millet, Green gram, Cropping sequence, Seed yield.*

INTRODUCTION

Millets are very high in their nutrition content. Each millets are three to five times nutritionally superior to rice and wheat in terms of proteins, minerals and vitamins so now Millet Network of India promotes milets as "Nutri-cereals" instead of Coarse Cereals.

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Millets are rich in vitamin B, calcium, iron, potassium, magnesium, zinc, also gluten-free and has low-GI (Glycemic index) thus millets are suitable for people allergies/intolerance of wheat. Also for diabetic, weight loss millets are excellent.

India is the largest producer of many kinds of minor millets, among them, little millet i.e. commonly termed as Vari, Samo, Samai, Kutki (*Panicum sumatrense* roth exRoem and Schult) is one of the important small millet grown for food grain and fodder, especially in tribal predominant areas. The crop is hardy and well suited to upland farming ecosystems, because of its early maturity and quick growing nature. Little millet is a humble grain with nutritional and health benefits. It contains 1.2 % fat, 7.7 % protein and 68.8% carbohydrate. Wide adaptation, easy cultivation, free from major pest and diseases and drought tolerance has made this crop an indispensable component of dry farming system.

In India, small millets are cultivated on 6.19 lakh ha with production of 4.42 lakh tones with a productivity of 714 kg/ha. In Gujarat, small millets occupies an area about 0.22 lakh ha with a production of 0.28 lakh ha with a productivity of 1273 kg/ha (Anon., 2017). The major little millet growing states are Karnataka, Andhra Pradesh and Tamil Nadu. In Gujarat, little millet cultivated mainly in hilly, dry land and tribal area of Dang, Valsad, Navsari and Panchmahal districts.

The basic concept of integrated nutrient management (INM) is the maintenance or adjustment of soil fertility and supply plant nutrients to an optimum level for sustaining the desired crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner[11]. The appropriate combination of mineral fertilizers, organic manures and crop residues varies according to the system land use, ecological, social and economic conditions. In spite of increased use of fertilizer nutrients, there is a gap between the nutrients applied and nutrients harvested, which is likely to widen further with the achievement of targets, leading to mining of soil. Experiences from long term fertilizer experiments revealed that integrated use of vermin compost, bio compost, *etc.* with graded levels of chemical fertilizers is promising not only in maintaining higher productivity but also in providing maximum stability in crop production.

MATERIAL AND METHOD

The investigation was conducted at the Rajendrapur Farm, Krishi Vigyan Kendra, Navsari Agricultural University, Waghai (Dist-Dangs) during the years 2016-17 and 2017-18. The soil of the experimental field was clayey in texture, medium in organic carbon (0.70%), available nitrogen (282.73 kg/ha) and available phosphorus (46.83 kg/ha) whereas high in available potassium (373.28 kg/ha). The soil was slightly acidic in reaction (pH 6.8). The treatment consisted of integrated nutrient management *viz*. T_1 – 100% RDF (40:20:00 NPK kg/ha) , T_2 – 50% RDN through chemical fertilizer + 50% RDN through biocompost, T_3 – 50% RDN through chemical fertilizer + 50% RDN through vermin compost, T_4 – 75% RDN through chemical fertilizer + 25% RDN through bio compost, T_5 – 75% RDN through chemical fertilizer + 25% RDN through vermin compost and *Azotobacter* and PSB applied each 2 lit/ha for all treatment to little millet in *kharif* season as main plot treatments replicated four times in randomized block design. Organic manures (bio compost and vermin compost) were applied to little millet as per treatments and evenly spread and mixed in that particular bed. The little millet was fertilized as per treatments. The nitrogen was applied through Urea (46% N) whereas; phosphorus was applied through single superphosphate (16% P_2O_5). The 50% dose of nitrogen and full dose of phosphorus were applied at the time of transplanting and remaining 50 % dose of nitrogen was applied 30 days after transplanting. In case of phosphorus fertilizer, the quantity of phosphorus from bio-compost and vermin compost was counted and deducted from the quantity of recommended

dose of phosphorus and remaining phosphorus was applied in the form of single superphosphate. During *rabi* season each main plot treatment was split into four sub-plot treatments with four levels of recommended dose of fertilizer *viz.*, S_1 -control, S_2 50% RDF (10:15:00 NPK kg/ha), S_3 -75% RDF (15:30:00 NPK kg/ha) and S_4 100% RDF (20:40:00 NPK kg/ha) to green gram resulting in twenty treatment combinations replicated four times in split plot design. The experiment was conducted on same site without changing the randomization of the treatment for the successive year to assess the residual effects. The data recorded were statistically analyzed using MSTATC Software. The purpose of analysis of variance was to determine the significant effect of treatments on finger millet. LSD test at 5 per cent probability level was applied when analysis of variance showed significant effect for treatments.

RESULTS AND DISCUSSION

Growth

All the growth attributes (Table 1) *viz*., plant height, dry matter accumulation per plant and total number of productive tillers per plant were significantly influenced by the integration of chemical fertilizers with organic sources at 30 DAT, 60 DAT and 90 DAT and at harvest. At all the growth stages application of 100% RDF (T_1) significantly increased the growth in terms of plant height, dry matter accumulation per plant and total number of productive tillers per plant, which was at par with 75% RDN through chemical fertilizer + 25% RDN through vermicompost (T_5) during pooled analysis. The growth of plant is greatly influenced by soil environment. Here the treatment with integration of chemical and organic sources provided enough amounts of nutrients and organic matter which ultimately influenced the soil environment in positive ways for plant growth. The favourable soil condition finally resulted into higher values of almost all growth parameters under this treatment. Nitrogen being a constituent of the plant cell influenced different physiological processes such as a cell division, cell elongation and chlorophyll production which ultimately resulted in better growth attributes. These findings are in close agreement with those reported by Umesh *et al.*[13], Thimmaiah *et al*.[10] and Shubhashree *et al.*[9].

Yield and yield attributes

All yield attributes (Table 2) *viz*., number of panicles per m^2, main panicle length and test weight were favorably influenced by INM treatments. These yield attributes played vital role in determining final yield of little millet. All these yield components showed significantly higher values of yield attributing characters with combination of chemicals and organics over control. The important yield components like number of panicles per m^2, main panicle length and test weight were significantly higher with application of 100% RDF (T_1), which was remained at par with 75% RDN through chemical fertilizer + 25% RDN through vermin compost (T_5) during pooled result. Similar results have also been reported by Parihar *et al.*[6], Rani *et al.*[7] and Ullasa *et al.*[12].

Little millet produced significantly higher grain and straw yield (Table 2) with the application of 100% RDF (T_1), which was at par with 75% RDN through chemical fertilizer + 25% RDN through vermin compost (T_5) during pooled. Grain yield and straw yield are directly related with the growth and yield attributes. All the growth and yield attributes were higher with application of 100% RDF (T_1) followed by 75% RDN through chemical fertilizer + 25% RDN through vermin compost (T_5). The increased grain and straw yield can also be ascribed to the effect of adequate availability of NPK in soil solution, may cause increase in root growth, thereby increasing uptake of nutrients. Higher yield due to combined application of chemical fertilizers and organic manures might have attributed to sustained nutrient supply and also as a result of better utilization of applied nutrients through improved micro environmental conditions, especially the activities of soil microorganisms involved in nutrient transformation and fixation. These findings are in close agreement with those reported by Kumara *et al.*[5],

Senapati *et al.*[8], Basavaraju and Purushotham[2], Jagathjothi *et al.*[4], Chaudhari *et al.*[3] and Shubhashree *et al.*[9].

The effect of integration of chemicals and organics on harvest index *i.e.* partitioning of photosynthates between vegetative and reproductive organs was non significant during both the years of experiment as well as in pooled analysis, indicating proportionate partitioning with increasing and decreasing supply of nitrogen. These findings are in agreement with Senapati *et al.*[8].

Table 1: Effect of integrated nutrient management on growth of *kharif* little millet under little millet-green gram copping sequence (2 year Pooled data)

Treatment	Plant height (cm)				Dry matter accumulation/plant (g)				Total number of productive tillers/plant
	30 DAT	60 DAT	90 DAT	At harvest	30 DAT	60 DAT	90 DAT	At harvest	At harvest
T_1: 100% RDF	60.73	114.75	146.98	163.65	6.18	14.68	25.96	31.05	4.58
T_2: 50% RDN through chemical fertilizer + 50 % RDN through biocompost	52.68	93.58	122.13	139.83	5.45	11.44	21.00	23.06	3.08
T_3: 50% RDN through chemical fertilizer + 50% RDN through vermicompost	54.55	95.55	124.70	141.70	5.48	11.85	21.76	24.66	3.19
T_4: 75% RDN through chemical fertilizer + 25% RDN through biocompost	56.90	110.45	138.95	154.15	5.81	13.51	24.09	28.76	4.08
T_5: 75% RDN through chemical fertilizer + 25% RDN through vermicompost	58.83	111.83	140.35	156.10	5.89	13.86	24.75	29.16	4.20
SEm±	1.41	3.16	3.43	3.60	0.17	0.40	0.69	0.88	0.16
CD (P=0.05)	4.07	9.13	9.91	10.40	0.48	1.16	2.00	2.50	0.47
CV (%)	7.54	9.15	7.74	7.28	8.75	9.25	8.94	9.67	12.93
General mean	56.74	105.23	134.62	151.09	5.76	13.07	23.51	27.34	3.82

- *Azotobacter* and PSB applied each 2 lit/ha for all treatment

Table 2: Effect of integrated nutrient management on yield attributes and yield of *kharif* little millet under little millet-green gram copping sequence (2 year Pooled data)

Treatments	Number of panicles/m^2	Main panicle length (cm)	Test weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)	Harvest index (%)
T_1: 100% RDF	118.00	35.17	2.41	2057	5857	25.95
T_2: 50% RDN through chemical fertilizer + 50 % RDN through biocompost	99.38	28.33	2.24	1658	4909	25.29
T_3: 50% RDN through chemical fertilizer + 50% RDN through vermicompost	100.88	29.03	2.27	1731	5076	25.48
T_4: 75% RDN through chemical fertilizer + 25% RDN through biocompost	110.75	33.12	2.33	1920	5528	25.78
T_5: 75% RDN through chemical fertilizer + 25% RDN through vermicompost	111.88	34.10	2.36	1949	5639	25.71
SEm±	2.78	0.89	0.04	44.25	110.27	0.52
CD (P=0.05)	8.03	2.58	0.11	127.85	318.58	NS
CV (%)	7.84	8.47	4.95	7.20	6.20	6.21
General mean	108.18	31.95	2.32	1863	5402	25.64

- *Azotobacter* and PSB applied each 2 lit/ha for all treatment

CONCLUSION

On the basis of experimental results, little millet should be nourished with 75% RDN through chemical fertilizer + 25% RDN through vermicompost reported promising effect on growth, yield attributing characters and yield of little millet in little millet-green gram cropping sequence under South Gujarat condition.

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