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Effect of integrated nutrient management on growth, yield and quality of ridge gourd (*Luffa acutangula* L.) cv. GRG-2

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Abstract
The experiment was conducted during the summer 2021 at Educational Farm, Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh. There were eight treatment combinations replicated thrice in a randomized block design. Among the eight treatments combination tested, T_3 (50% N from vermicompost + 50% N from inorganic fertilizers) produce best performance in growth parameter like leaf length (16.93 cm) and width of leaf (19.02 cm) at 65 days; days to first male flower (37.22), days to first female flower (42.59), node number of first female flower appearance (10.02), days to first picking (52.73), main vine length at last harvest (4.73 m). The yield and yield attributes *viz*; length of fruit (30.24 cm), weight of fruit (125.49 g), number of fruits per plot (104.71), yield per plot (13.15 kg) and per hectare (8.22 t). As well as quality parameter like, TSS (5.72 °B) and ascorbic acid content (10.65 mg 100 g^{-1}). Also found highest BCR (3.33) was found in the treatment T_3 (50% N from vermicompost + 50% N from inorganic fertilizers). On the basis of the results obtained during present investigation, it was observed that integrated use of 50% N from vermicompost + 50% N from inorganic fertilizers essential for improving growth parameter, yield, quality and also economically viable for ridge gourd production.

Keywords: Ridge gourd, vermicompost, inorganic fertilizer, yield attributes

Introduction
Vegetables are an essential source of vitamins, proteins, carbohydrates, and minerals. Vegetables make up a substantial percentage of most people's diets. Growing vegetable cultivation plays an important role in ensuring that people obtain enough of these carbohydrates, vitamins and minerals for a healthy diet. India is positioning second place among the vegetable producing countries of the world after China. Vegetable is not only important in diet but they can also help in improving economic condition of farmers.

Ridge gourd is one of major vegetable crop in Asia. Ridge gourd is also known as "Ribbed Gourd" and scientific name of ridge gourd is "*Luffa acutangula* L.*"* This vegetable belongs to family of 'Cucurbitaceae' and genus of "Luffa" (Loofah). The name luffa is given due to presence of gelatinous principle luffein. It is a vegetable of commercial importance and green immature fruits are cooked as vegetable and used as in preparation of chutney and curries. Fiber of mature dry fruit is used as batting sponge, scrubber pad, doormats, pillows, mattresses and cleaning utensils. It is also sound absorbing material used in USA. The chemical constituents of ridge gourd fruits include carbohydrates, carotene, fat, protein, phytin, flavonoids, saponin and amino acid. Kandlakunta *et al.* (2008) [6] reported that ridge gourd containing 300 µg β-carotene and 1000 µg carotenoids per 100 g fresh fruits. It has various pharmacological activity like the hepatoprotective, antidiabetic, antioxidant, antifungal activity. It is also excellent blood purifier, cure for jaundice, weight loss, antibiotic, fortifying the immune systems, skin cure, good for stomach. In recent years, focus has been mostly placed on environmentally friendly organic products for human consumption. Organic vegetable nutrition is especially important since it provides high-quality meals that are essential for the country's large vegetarian population's health. The vegetables should be free of residual effects because they are typically ingested raw or slightly cooked.

The continuous application of inorganic fertilizers without organic manure has led to a deterioration of soil properties like physical, chemical, and biological, as well as increasing pollution of soil and water. Hence, integrated use of organic and inorganic fertilizers is the need of the hour for sustainable productivity and maintaining better soil health. Application of low-cost inputs with organic and inorganic fertilizer as part of an integrated nutrient management strategy plays a significant role in plant nutrition. Integrated nutrient management involves the judicious use of organic and inorganic fertilizers leading to a significant reduction in the use of chemical fertilizers. It also aids in ecological safety, resource exploitation, and enhanced soil and crop productivity to correct micronutrient deficiencies and increase fertilizer efficiency (Johan *et al*., 2001) [5]. Therefore, the present in resignation was undertaken to study the effect of integrated nutrient management on growth, yield and quality of ridge gourd.

Materials and Methods

The experiment was conducted at Educational Farm, Polytechnic in Horticulture, Junagadh Agricultural University, Junagadh during the summer 2021. The experiment was laid out in Randomized Block Design (RBD) with three replications consist of eight treatments *i.e.*, T_1 (Control), T_2 (RDF-50: 25: 25 NPK kg ha^{-1}), T_3 (50% N from vermicompost + 50% N from inorganic fertilizers), T_4 (50% N from FYM + 50% N from inorganic fertilizers), T_5 (75% N from vermicompost + 25% N from inorganic fertilizers), T_6 (75% N from FYM + 25% N from inorganic fertilizers), T_7 (100% N from vermicompost) and T_8 (100% N from FYM). The field was thoroughly prepared and application of vermicompost, FYM, Single Super Phosphate (SSP) and Muriate of Potash (MOP) at the time of sowing. Nitrogen in the form of urea was applied in the two splits *i.e.*, 50% dose at sowing and 50% dose at 30 days after Sowing (DAS).

The observations regarding the growth parameters were recorded from four representative plants from each plot. The yield parameters were recorded from five representative fruits from each plot. The ridge gourd fruits were harvested at 3-5 days interval. Fresh weight of ridge gourd fruit was calculated on the basis of yield per plot and the fruit yield was expressed in t/ha. The quality parameters such as moisture content in fruit was estimated on oven dry basis (Ranganna, 1986) [11] and was expressed in percentage. TSS was estimated by using hand refractometer method (Ranganna, 1986) [11] an. The ascorbic acid content in the fruit was estimated by using 2, 6-dichlorophenol indophenols titration method (A.O.A.C., 1990) [1].

Results and Discussion

Effect of INM on growth parameter

The data pertaining to the effects of different treatments of INM on the growth parameters of ridge gourd are presented in Table 1. Maximum length of leaf (14.68 cm and 16.93 cm) and width of leaf (16.55 cm and 19.02 cm) was observed at 45 and 65 DAS in treatment T_2 (RDF (50-25-25 NPK kg ha^{-1})) and T_3 (50% N from vermicompost + 50% N from inorganic fertilizers), respectively. The treatment consisting 50% N from vermicompost + 50% N from inorganic fertilizers was observed minimum days to first male flower days (37.22 days), first female flower days (42.59 days), node number to first female flower (10.02), days to first picking (52.73 days) and maximum length of main vine at last harvesting (4.73 m) as compared to all other treatments. The lowest growth attributing characters were found in control treatment.

Growth parameter like length and width of leaf and main vine length is might be due the judicious integration of organic manure with inorganic fertilizer is able to supply optimal nutrient levels for a longer period of time, slow release, and favorable growing media. Similar result reported by Rathod *et al.* (2018) [12], Choudhary *et al.* (2020) [2] in ridge gourd and Singh *et al.* (2020) [2] in cucumber. Vermicompost being a rich source of micro nutrients like ZN, Fe, Cu and Mn are involved in synthesis of plant hormones like auxin (IAA) through tryptophane pathway. Further, vitamins, minerals and phytohormones like auxin and other growth regulator presented in vermicompost might be the probable reason for inducing early flowering. Similar findings were also reported by Kharga *et al.* (2019) [8] in cucumber and Mashih *et al.* (2020) [9] in bitter gourd.

Effect of INM on yield attributing characters, yield and economics projection

Table 2 shows that combining 50% N from vermicompost with 50% N from inorganic fertilisers significantly improved yield attributing characters such as fruit length (30.24 cm), average fruit weight (125.49 g), number of fruits per plot (104.71), yield per plot (13.15 kg), yield per hectare (8.22 t), and highest BCR (3.33). Maximum fruit girth (13.17 cm) was observed in treatment T_5 (75% N from vermicompost + 25% N from inorganic fertilizers). This might be due to the all the yield parameter and yield improved due to the application of vermicompost because, vermicompost provided better nutrient status by improving the physical, biological and chemical properties of soil. Vermicompost reduce the compactness of soil resulting better root development and deep penetration root system which facilitated better absorption of water as well as nutrients. Similar result reported by Thriveni *et al.* (2015) [14] in bitter gourd and Rathod *et al.* (2018) [12] in ridge gourd.

Effect of INM on quality parameter

Treatment application of 50% N from vermicompost + 50% N from inorganic fertilizers increased quality parameters such as TSS (5.72 °B) and ascorbic acid content (10.65 mg/100 g) significantly more than most other treatment combinations, as shown in Table 3. The lowest moisture content (91.31%) was found in a 50 percent N from vermicompost + 50 percent N from inorganic fertilizers combination, but the difference was not significant. Similar result was found by Rathod *et al.* (2018) [12] in ridge gourd and Mashih *et al.* (2020) [9] in bitter gourd. The might due to ridge gourd responded favorable to application of organic amendment like vermicompost and this enhanced the antioxidant (vitamin C) content of the leaves and fruits. Vermicompost released nutrient in soil and provided favorable condition in the plant root zone resulting higher absorption or uptake of major as well as minor nutrient which might have directly related to concentration of TSS in fruits.

Conclusion

Based on the findings of this study, it was found that integrating 50% N from vermicompost with 50% N from inorganic fertilisers enhances growth, yield, and quality parameters while being cost-effective for ridge gourd production.

Table 1: Effect of INM on growth parameters of ridge gourd

Treat. No.	Treatment details	Leaf length (cm)		Leaf width (cm)		Days to first male flower	Days to first female flower	Node number to first female flower	Days to first picking	Main vein length (m)
		45 Days	65 Days	45 Days	65 Days					
T_1	Control	10.90	13.25	12.64	14.60	47.79	54.14	14.14	65.91	3.54
T_2	RDF (50-25-25 NPK kg ha^{-1})	14.68	16.06	16.55	18.54	43.47	48.50	12.24	60.94	4.41
T_3	50% N from vermicompost + 50% N from inorganic fertilizers	14.19	16.93	16.08	19.02	37.22	42.59	10.02	52.73	4.73
T_4	50% N from FYM + 50% N from inorganic fertilizers	13.00	15.87	15.58	18.38	41.76	47.68	12.39	59.16	4.55
T_5	75% N from vermicompost + 25% N from inorganic fertilizers	13.51	15.60	15.95	18.28	39.27	45.09	10.83	56.00	4.48
T_6	75% N from FYM + 25% N from inorganic fertilizers	12.84	15.65	15.67	18.30	43.68	49.65	12.16	59.24	4.34
T_7	100% N from vermicompost	12.90	15.55	14.97	18.13	42.60	49.33	11.76	61.79	3.91
T_8	100% N from FYM	12.70	14.93	14.84	17.77	44.11	50.19	12.44	61.66	3.85
S. Em. ±		0.55	0.56	0.57	0.66	1.68	1.80	0.46	2.09	0.18
C. D. at 5%		1.56	1.58	1.62	3.30	4.79	5.13	1.32	5.95	0.51
C.V.%		7.25	6.22	6.44	6.41	6.86	6.45	6.68	6.06	7.29

Table 2: Effect on INM on yield attributing characters, yield and economic projection of ridge gourd

Treat. No.	Treatment Details	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	No. of fruits/plot	Fruit yield (kg/plot)	Fruit Yield (t/ha)	BCR
T_1	Control	21.61	9.84	91.76	76.79	7.05	4.40	2.18
T_2	RDF (50-25-25 NPK kg ha^{-1})	25.50	10.87	109.68	91.95	10.09	6.31	2.97
T_3	50% N from vermicompost + 50% N from inorganic fertilizers	30.24	12.18	125.49	104.71	13.15	8.22	3.33
T_4	50% N from FYM + 50% N from inorganic fertilizers	25.83	11.04	119.29	92.40	10.95	6.84	3.04
T_5	75% N from vermicompost + 25% N from inorganic fertilizers	28.63	13.17	120.49	96.14	11.63	7.27	2.73
T_6	75% N from FYM + 25% N from inorganic fertilizers	25.21	10.81	107.46	94.71	10.19	6.37	2.75
T_7	100% N from vermicompost	24.85	10.79	110.98	91.57	10.08	6.30	2.20
T_8	100% N from FYM	24.82	10.77	105.52	88.91	9.38	5.86	2.44
S. Em. ±		1.45	0.61	5.33	4.69	0.58	0.36	-
C. D. at 5%		4.13	1.74	15.18	13.36	1.64	1.02	-
C.V.%		9.73	9.49	8.29	8.82	9.65	9.65	-

Table 3: Effect of INM on quality parameters of ridge gourd

Treat. No.	Treatment details	TSS (°B)	Ascorbic acid (mg/100g)	Moisture content (%)
T_1	Control	5.12	9.30	94.59
T_2	RDF (50-25-25 NPK kg ha^{-1})	5.60	9.65	93.43
T_3	50% N from vermicompost + 50% N from inorganic fertilizers	5.72	10.65	91.31
T_4	50% N from FYM + 50% N from inorganic fertilizers	5.67	10.06	91.78
T_5	75% N from vermicompost + 25% N from inorganic fertilizers	5.65	10.11	91.51
T_6	75% N from FYM + 25% N from inorganic fertilizers	5.54	9.83	92.02
T_7	100% N from vermicompost	5.55	9.62	92.64
T_8	100% N from FYM	5.30	9.59	93.45
S. Em. ±		0.10	0.17	1.08
C. D. at 5%		0.29	0.49	NS
C.V.%		3.19	3.00	2.02

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