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Standardization of organic cultivation practices on economics in bitter gourd (*Momordica charantia* L.) var. Pusa Aushadhi

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Abstract
The present investigation entitled "Standardization of organic cultivation practices on economics in bitter gourd (*Momordica charantia* L.) var. Pusa Aushadhi" was carried out during *rabi* season in the year 2021-2022 at P.G research farm, College of Horticulture, Rajendranagar, Hyderabad. Sri Konda Laxman Telangana State Horticultural University. The experiment was carried out with twenty (20) treatments in Randomized Block Design with three (3) replications *i.e.* T_1: Farmyard manure (25 t/ha) + AMC (12.5 kg/ha), T_2: Farmyard manure (25 t/ha) + VAM (10 kg/ha), T_3: Farmyard manure (30 t/ha) + AMC (12.5 kg/ha), T_4: Farmyard manure (30 t/ha) + VAM (10 kg/ha), T_5: Vermicompost (10 t/ha) + AMC (12.5 kg/ha), T_6: Vermicompost (10 t/ha) + VAM (10 kg/ha), T_7: Vermicompost (12 t/ha) +AMC (12.5 kg/ha), T_8: Vermicompost (12 t/ha) +VAM (10 kg/ha), T_9: Poultry manure (6 t/ha) + AMC (12.5 kg/ha), T_{10}: Poultry manure (6 t/ha) + VAM (10 kg/ha), T_{11}: Poultry manure (8 t/ha) + AMC (12.5 kg/ha), T_{12}: Poultry manure (8 t/ha) + VAM (10 kg/ha), T_{13}: Neem cake (1 t/ha) + AMC (12.5 kg/ha), T_{14}: Neem cake (1 t/ha) + VAM (10 kg/ha), T_{15}: Neem cake (2 t/ha) + AMC (12.5 kg/ha), T_{16}: Neem cake (2 t/ha) + VAM (10 kg/ha), T_{17}: RDF (40: 80: 50 NPK kg/ha) + AMC (12.5 kg/ha), T_{18}: RDF(40: 80: 50 NPK kg/ha) + VAM (10 kg/ha), T_{19}: RDF (40: 80: 50 NPK kg/ha), T_{20}: Absolute control. Different treatment combinations of RDF and organic manures along with bio fertilizers have a significant influence on economics. The data on economics recorded that the treatment T_{11}: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly highest gross returns per hectare (Rs. 4,05,750), highest net returns per hectare (Rs. 2,99,012.5) and best benefit cost ratio (2.8:1) compared to the other treatments.

Keywords: Bitter gourd, Farmyard manure, Vermicompost, Poultry manure, Neem cake, AMC, VAM, Pusa Ausadhi

Introduction
Bitter gourd (*Momordica charantia* L.) is diploid in nature (2n=22) and belongs to family Cucurbitaceae. It grows best in well-drained loamy soil with a pH of 6.5-7.0. Although the plant is adaptable to a wide range of climates, it produces best in hot climates (Binder *et al.*, 1989) [5].

Annual production of bitter Gourd in India, cultivated over 114,771 ha and yields about 2,448 kgs / ha. In Telangana, bitter gourd crop occupies 960 ha and 22,660 MT in production (Ministry of Agriculture and Farmers Welfare) [13].

Momordicin, Momordicinin, and Momordicilin are three pentacyclic triterpenes, accumulate over time and cause the fruit to become bitter; the bitterness then dissipates as the fruit ripens [(Begum *et al.*, 1997) [2]; (Cantwell *et al.*, 1996)] [6]. Fruits have a high vitamin C content (88 mg/100g). It has antioxidant, antimicrobial, antiviral, antihepatotoxic, antiulcerogenic, and blood sugar lowering properties (Behera *et al.*, 2011) [3]. It also has a lot of medicinal properties like germicidal effect, laxative, curing blood diseases, rheumatism, diabetes, asthma, AIDS etc. Bitter gourd has hypoglycemia (blood sugar reducing) characteristics, hence used as an anti-diabetic and hypoglycemic agent (Palaniswamy *et al.*, 2011) [14]. It possesses anti-inflammatory, antiviral, anticancer, anti-leukemia, anti-tumor, analgesic, abortifacient, immune suppressive, blood-cleansing, blood sugar-lowering, hormone-

balancing properties that combat free radicals, kill cancer cells, kill leukemia cells, and prevent tumors (Taylor, 2005) [18].

The utilization of pricey commercial fertilizers, which are tremendously expensive for small and marginal farmers made it possible to substitute a combination of organic manures and bio-fertilizers in place of chemical fertilizers which increase soil fertility, crop productivity and yielding high-quality fruits. Organic farming involves the use of organic manures and naturally occurring substances such as biofertilizers, biopesticides, botanicals, and integrated pest management. To maintain environmental quality and safety. Organically grown vegetables are nutritious and valuable, with lower post-harvest losses. Biofertilizers are associations that supplement plant food. Biological nitrogen fixation, solubilization of insoluble phosphate, or synthesis of hormones, vitamins, and other plant growth factors are some of the ways that carrier-based microorganisms found in biofertilizers serve to enhance productivity (Bhattacharyya *et al*., 2000) [4].

Farmyard manure enhances soil permeability to air and water while continuing to increase nutrient uptake, improves soil moisture holding capacity, cation exchange capacity (CEC) and moderates soil pH. They also rise soil bulk density and promote microorganism activity (Subedi, 1998) [17].

Vermicompost has been found to have high potential as a soil amendment. It has been discovered to be an ideal organic nutrient source because it is high in macro and micro-nutrients, which help to increase yields (Hidalgo *et al.*, 1999) [9].

Poultry manure is the best and richest because liquid and solid excreta are expelled simultaneously, preventing urine loss. It contains growth-promoting substances that promote plant growth and yield of crop (Samman *et al.*, 2008) [16]. It improves soil structure, nutrient retention, aeration, soil moisture holding capacity, water infiltration, and P availability to plants (Garg and Bahl, 2008) [8].

Neem cake boosts soil aeration, water holding capacity, soil texture, and organic matter content for better crop development and increase in dry matter.

Arka Microbial Consortium is a carrier-based product that contains N-fixing, P- and Zn-solubilizing, and Plant Growth Promoting Microbes in a single formulation. The novelty of this technology is that farmers need not apply Nitrogen fixing, Phosphorous solubilizing and growth promoting bacterial inoculants separately. It is easily applied through seed, soil, water, and nursery media such as coco-peat (Aswathi *et al.*, 2020) [1].

Mycorrhiza has a symbiotic relationship with plant roots and fungal mycelia which facilitates nutrient uptake, particularly phosphorus, zinc and sulphur and production of growth hormones such as gibberellic acid, indole acetic acid, dihydrozeatin which accelerates plant growth (Ikiz *et al.*, 2009) [10] and crop yield (Dasgan *et al.*, 2008) [7].

Materials and Methods

The present investigation was carried out during *rabi* season in the year 2021-2022 at P.G research farm, College of Horticulture, Rajendranagar, Hyderabad. Sri Konda Laxman Telangana State Horticultural University. The experimental site is situated at a latitude of 17º.32' North, longitude of 78º.40' East and altitude of 542.3 m above mean sea level. The plots were demarcated into three (3) replications, each replication with twenty (20) treatments and experimental design followed is Randomized Block Design (RBD). The experimental field had sixty (60) plots.

The protrays were selected, cleaned and filled with cocopeat: perlite: vermiculite in the ratio of 3:1:1 suitable for rooting media. The seeds were soaked for overnight and imbibed seeds were sown and were kept in shade net for germination purpose. The seedlings at two leaf stage planted into already prepared plots.

The biofertilizers *viz*., Arka Microbial Consortium (AMC) and Vesicular Arbuscular Mycorrhiza (VAM) were added (12.5 kg/ha and 10 kg/ha) respectively to all organic manures for multiplication purpose. Biofertilizers enriched organic manures *viz*., well decomposed farm yard manure (25t/ha and 30t/ha), vermicompost (10t/ha and 12 t/ha), poultry manure (6 t/ha and 8 t/ha) and neem cake (1 t/ha and 2 t/ha) were applied to the respective pits 15 days before transplanting of seedlings and were thoroughly mixed with soil. The recommended doses of Nitrogen, Phosphorous and Potassium @ 60:120:30 kg/ha were applied to the respective pits in the form of Urea, Single Super Phosphate and Muriate of Potash respectively. Half dose of urea and the entire dose of Single Super Phosphate and Muriate of Potash were applied at the time of transplanting as a basal application and the remaining half dose of Urea was divided into two split doses and were applied at 30 and 60 days after transplanting of seedlings. All other cultural and plant protection measures were done as per the recommended package of practices for the healthy crop.

The data collected were analyzed statistically by following the analysis of variance (ANOVA) technique (Panse and Sukhatme 1985) [15]. Statistical significance was tested with 'F' value at 5 per cent level of significance and whenever the F value was found significant, Critical difference was worked out at five per cent level of significance.

Results and Discussion

Economics

The data pertaining to economics as influenced by different treatment combinations of RDF and organic manures along with bio fertilizers are presented in the Table 1.

Benefit cost ratio decides about the economic feasibility of the treatment whether to be recommended or not. Because, unless and until a technique is beneficial, a farmer will not adopt. It is also a significant and crucial aspect in determining the optimum levels of input to be employed to maximize crop yield and returns from the crop. The cost of cultivation and net returns and gross returns analysis for each treatment (B:C ratio).

Among the treatments, T_{11}: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded significantly maximum gross returns per hectare (Rs. 4,05,750), maximum net returns per hectare (Rs. 2,99,012.5) with best benefit cost ratio (2.8:1) and T_{20}: Absolute control recorded significantly minimum gross returns per hectare (Rs. 97800), minimum net returns per hectare (Rs. 16812.5) with lowest benefit cost ratio (0.2:1).

It is evident from the data that, maximum gross returns were recorded in T_{11}: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) which might be due to fetching price of organic bitter gourds in the market as compared to other treatments.

These results are in accordance with the reports of Meerabai *et al.* (2007) [12] in bitter gourd; Lodhi *et al.* (2017) [11] in broccoli.

Cost of cultivation of crop (fixed cost for all treatments) on per hectare area basis in bitter gourd.					
S.no	**Particulars**	**Unit**	**Qty.**	**Rate/unit (Rs)**	**Cost Rs/ha**
A.	Field Preparation Ploughing with M. B. Plough	Hrs	3.5	300	1050
	Disc harrow	Hrs	5	300	1500
	Planking and levelling	Hrs	3	300	900
	Layout of the field	Labour	10-man days	400	4000
B.	Fertilizer application Application cost	Labour	10-man days	400	4000
C.	Sowing Cost of seed	Kg	5kg/ha	1175	5875
	Sowing of seed in nursery	Labour	2-man days	400	800
D.	Transplanting Transplanting seedlings into the main field	Labour	10-man days	400	4000
	Gap filling	Labour	5-man days	400	2000
E.	Irrigation Tube well charges -10 Irrigation (2 hrs./ irrigation)	Hrs	15	300	4500
	Labour for irrigation	Labour	10-man days	400	4000
F.	Training Training	Labour	30-man days	400	12000
G.	Weeding Hand weeding	Labour	20-man days	400	8000
H.	Harvesting, Transporting and Marketing Harvesting	Labour for 15 Pickings	3-man days x 15 pickings	45 x 400	18000
	Transporting and marketing				3000
1.	Common cost				73625
2.	Miscellaneous cost	10% of common cost			7362.5
	Grand total (1+2)				80987.5

Cost of cultivation of crop (fixed cost for all treatments) and Benefit: Cost ratio on per hectare area basis in bitter gourd										
Treatments	**FYM**	**V.C**	**P.M**	**N.C**	**AMC**	**VAM**	**Urea**	**SSP**	**MOP**	**Total**
T_1	25000				1750					26750
T_2	25000					1000				26000
T_3	30000				1750					31750
T_4	30000					1000				31000
T_5		80000			1750					81750
T_6		80000				1000				81000
T_7		96000			1750					97750
T_8		96000				1000				97000
T_9			18000		1750					19750
T_{10}			18000			1000				19000
T_{11}			24000		1750					25750
T_{12}			24000			1000				25000
T_{13}				15000	1750					16750
T_{14}				15000		1000				16000
T_{15}				30000	1750					31750
T_{16}				30000		1000				31000
T_{17}					1750		522	6003	1800	10075
T_{18}						1000	522	6003	1800	9325
T_{19}							522	6003	1800	8325
T_{20}										

Table 1: Effect of different treatment combinations of RDF and organic manures along with biofertilizers on benefit cost ratio

Treatments	**Common cost (Rs/ha)**	**Treatment cost (Rs/ha)**	**Total cost of cultivation (Rs/ha)**	**Yield (t/ha)**	**Gross returns (Rs/ha)**	**B:C ratio**
T_1	80987.5	26750	107737.5	10.66	266500	1.47
T_2	80987.5	26000	106987.5	9.81	245250	1.29
T_3	80987.5	31750	112737.5	12.32	308000	1.73
T_4	80987.5	31000	111987.5	11.54	288500	1.58
T_5	80987.5	81750	162737.5	13.45	336250	1.07
T_6	80987.5	81000	161987.5	12.89	322250	0.99
T_7	80987.5	97750	178737.5	15.34	383500	1.15
T_8	80987.5	97000	177987.5	15	375000	1.11
T_9	80987.5	19750	100737.5	14.21	355250	2.53
T_{10}	80987.5	19000	99987.5	13.9	347500	2.48
T_{11}	80987.5	25750	106737.5	16.23	405750	2.80

T_{12}	80987.5	25000	105987.5	15.82	395500	2.73
T_{13}	80987.5	16750	97737.5	8.61	215250	1.20
T_{14}	80987.5	16000	96987.5	8.34	208500	1.15
T_{15}	80987.5	31750	112737.5	9.32	233000	1.07
T_{16}	80987.5	31000	111987.5	8.92	223000	0.99
T_{17}	80987.5	10075	91062.5	20.01	300150	2.30
T_{18}	80987.5	9325	90312.5	19.31	289650	2.21
T_{19}	80987.5	8325	89312.5	18.71	280650	2.14
T_{20}	80987.5		80987.5	6.52	97800	0.21

Market price of bitter gourd price - Rs.15/kg and Organic bitter gourd price - Rs. 25/kg

Conclusion

Based on the study, it was concluded that, different treatment combinations of RDF and organic manures along with bio fertilizers have a significant influence on quality in bitter gourd. The experimental results revealed that application of T_{11}: Poultry manure (8 t/ha) + AMC (12.5 kg/ha) recorded highest gross returns per hectare (Rs. 4,05,750), highest net returns per hectare (Rs. 2,99,012.5) and best benefit cost ratio (2.8:1) compared to other treatments and was proved to be the best treatment in bitter gourd (*Momordica charantia*. L) var. Pusa Aushadhi.

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