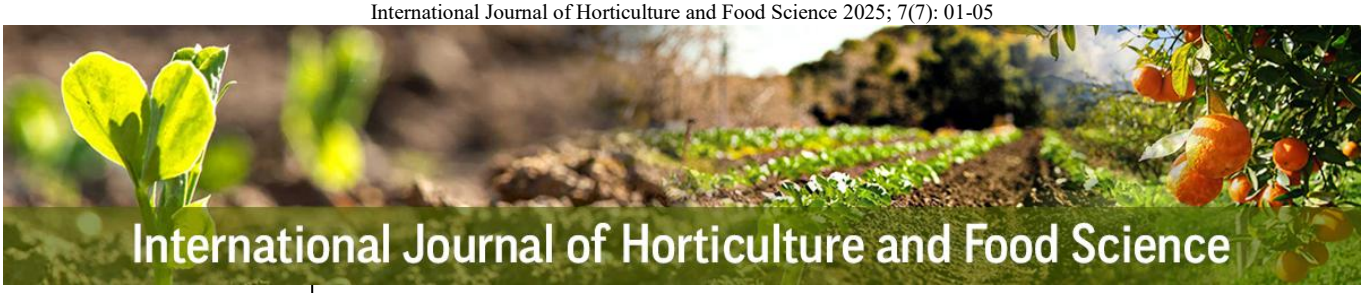

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Effect of organic manures and liquid consortia on growth, yield and quality of onion

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Abstract
An experiment was conducted entitled "Effect of Organic Manures and Liquid Consortia on Growth, Yield and Quality of Onion (*Allium cepa* L.)" during *rabi*, 2024-25 at Instructional Farm, School of Agricultural Sciences, Dabok, Udaipur. The experiment comprised of ten treatments using organic manures and liquid consortia either alone or in combinations which were replicated thrice in randomized block design. Onion variety N-53 was used as a test crop.
The results revealed that among all treatments T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia) was found to significantly increase growth, yield attributes, yield, quality parameters, as well as economics of onion. It was found that maximum value of growth parameters *viz*., plant height (58.67 cm), leaf length (45.23 cm), number of leaves plant^{-1} (11.85), neck thickness (11.85 mm), yield attributes and yield *viz*., bulb diameter (6.24 cm), fresh bulb weight (92.75 g), yield plot^{-1} (9.85 kg), yield ha^{-1} (45.60 t ha^{-1}) were observed with the application of T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). Further it was noted that maximum values of quality parameters *viz*., TSS (13.45 °Brix), chlorophyll content in leaf (65.42 mg 100 g^{-1}), were found with treatment T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). Maximum net return (₹682,500 ha^{-1}) and B-C ratio (3.85) were also obtained with T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia).

Keywords: Onion, organic manures and liquid consortia on growth, yield and quality

Introduction
Onions (*Allium cepa* L.) are a widely grown vegetable and have specific nutrient requirements to achieve optimal growth and yield. The onion (*Allium cepa* L.), a member of the Amaryllidaceae family, is a widely cultivated and valued vegetable crop with a diploid chromosome number of 2n = 16. Originally thought to have come from Central Asia, with early cultivation noted in Iran and Pakistan, onions are grown worldwide for their culinary and medicinal uses. This biennial plant is typically cultivated as an annual for its edible bulbs, which are rich in vitamins C and B6, folic acid and fiber as well as antioxidants like flavonoids and sulphur compounds known for their health benefits.
Applying both organic and inorganic fertilizers is part of managing nutrients in onions. Fertilizers made from organic materials, such as plants or animals, include compost, manure and green manure. Inorganic fertilizers also known as synthetic fertilizers are chemical-based and include nitrogen, phosphorus and potassium in various forms. Both types of fertilizers affect onions in different ways. Organic fertilizers improve soil structure, enhance microbial activity, and increase organic matter content. They help in better water retention and root development, which leads to improved onion growth. Organic amendments, such as farmyard manure or vermicompost, release nutrients slowly, supporting sustained growth over time. According to research by Mehta, (2023) [9] the application of organic fertilizers resulted in better bulb size, dry matter content and onion yield compared to untreated controls. Organic nutrients have been reported to improve the flavour, texture and nutritional quality of onions. They increase the content of sulphur compounds, which contribute to the pungency and overall quality of the onion bulb. Organic fertilizers contribute to lower environmental pollution and enhance biodiversity in the soil.

Organic farming is a system that integrates the interactions between soil, plants, water, soil microflora, and fauna; it is not just non-chemical agriculture. Organic farming aims in creating a healthy soil and helps in proper energy flows in soil, crop, water and environment, while the plant system keeps biological life cycle alive and helps in sustaining considerable levels in yield (Mishra, 2022) [1].

Alternative alternatives for supplying crops with the nutrients they need and filling up any future shortfalls include bio-fertilizers. Given the detrimental impact that chemical fertilisers alone have on soil health, employing organic manures in conjunction with biofertilizers will be ecologically friendly. Additionally, biofertilizers are widely acknowledged as inexpensive alternatives to chemical fertilisers that have no negative effects on the environment or soil health. Legumes are advised, and green manure crops should be used into organic farming wherever feasible as part of a sustainable rotation system.

Materials and Methods

The field experiment was carried out during November, 2024 to March, 2025 Horticulture farm, Department of Horticulture, School of Agricultural Sciences, Dabok, Udaipur. Geographically, Udaipur is located at 24° 34' N latitude and 73° 42' E longitude at an elevation of 582.17 meters above mean sea level (MSL). This particular part of India falls under agro climatic zone IV a *i.e.* "Sub-Humid Southern Plain and Aravalli Hills" of Rajasthan state. The geography of the experimental site was fairly levelled with an ample surface drainage and the field soil was having clay loam texture. In experiment conducted ten treatments in RBD Design with trice replications. In study, cultivar N – 53 and sees rate 10-12 kg $ha^{-1}$was used. For raising seedling of onion, raised beds of 1.5 m width and 10 m length were prepared. Seeds were sown in lines at 10 cm apart and at 1.0 cm depth. After sowing, the beds were covered with a thin layer of well-decomposed FYM and irrigated with a rose can. Regular irrigation was provided to maintain optimum moisture in the nursery beds. Forty-five days old seedlings were transplanted in the well prepared field Seedling were planted at the spacing of 15 cm x 10 cm (R x P).

Results and Discussion

Effect of Organic Manures and Liquid Consortia on Growth attributes

Data examine in Table 1 indicate that application of integrated nutrient management brought about a significant variation in growth parameters as *viz*., Plant height, Leaf length, Number of leaves $plant^{-1}$ and Neck thickness. The maximum plant height (58.67 cm) , maximum leaf length (45.23 cm) , number of leaves $plant^{-1}$ (11.85) and maximum neck thickness (11.85 mm) were recorded with the application of T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). These results were significantly superior to all other treatments. The result obtained by the use of poultry manure, Vermicompost and liquid consortia are due to rapid cell division, multiplication and cell elongation in meristematic region of plant which promoted vegetative growth of plant in the form of plant height, leaf length and number of leaves. Maximum value of growth parameters might be due to improved physio-chemical and biological properties of soil like water holding capacity, hydraulic conductivity, high rate of microbial transformation due to availability of organic carbon for heterotrophic organism, buffering effect, improved soil aggregation, aeration, release of organic acids etc. which act as stimulant for supply of crop nutrients during the course of microbial decomposition and enable the crop to utilize nutrient and water more efficiently (Patra and Sahoo 2023) [13].

The application of organic manure enhanced physiological processes including as transpiration, stomatal conductance, and photosynthesis. It suggests that the rise in these physiological processes may have contributed to improved nutrient absorption, improved digestion of carbohydrates, and the formation of new tissue, all of which in turn may have boosted vegetative growth. The results are in conformity with the findings of Kumar *et al*. (2016) [8]. Higher soil fertility and crop nutrient availability may be maintained and sustained with the help of organic manures. Utilized vermicompost and poultry manure to regulate nutrients enhanced the soil's chemical, physical, and biological characteristics, which promoted root development and may have enhanced nutrient absorption and effective translocation to the plant system during vegetative growth. Beneficial bacteria like as Azotobacter, Phosphate Solubilising Bacteria (PSB), and Potassium Mobilising Bacteria (KMB) are found in liquid consortia and are crucial for the growth and development of plants. Therefore, improved root development and plant growth may have been the outcome of balanced nutrition in the right nutritional environment.

Moreover, increasing value of growth parameters under T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia) might be due to increased availability of nitrogen, phosphorous and potassium to the plant initially through poultry manure and then by Vermicompost and liquid consortia matching the needs of plants throughout the cropping season. The findings of the present study are in the similar consent with the findings of Bairwa *et al.* (2015) [1], Singh (2015) [1] and Choudhary *et al.* (2021) [4] in onion.

Yield attributes and yield

A glance of the data represented in Table 2 clearly revealed in yield parameter Bulb diameter, Fresh bulb weight, Yield $plot^{-1}$ and Yield $hectare^{-1}$. Significantly increase in yield of onion bulb with the application of organic manures and liquid consortia. The maximum bulb diameter (6.24 cm), fresh bulb weight (92.75 g), yield $plot^{-1}$ (9.85 kg) and yield ha^{-1} (45.60 t ha^{-1}) were recorded with the application of treatment T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). The minimum values for yield attributes and yield were recorded with treatment T_1 (Control).

The delivery of nutrients in a balanced amount and appropriate availability may be the key factors for improved development of yield characteristics and bulb output. The application of organic manures and liquid consortia appeared to have a cumulative impact of increasing plant growth parameters, such as plant height, leaf length, number of leaves, and yield characteristics, which in turn led to a larger onion bulb yield. More locations for photosynthesis and the movement of photosynthates from source to sink (bulbs) were made possible by the improved plant development.

Patil (2017) [12] concluded that organic sources contain all macro and micro nutrients and also improve physio-

chemical and biological properties of soil which enables plant roots to proliferate resulting in better uptake of nutrients by crops. Rajput and Choudhary (2019) [15] reported that the physical, chemical, and biological qualities of the soil were enhanced by organic manures, which in turn raised the yield characteristics and bulb yield values. Additionally, soil microflora use organic sources as a source of energy to change inorganic nutrients that are already present in the soil into a form that developing plants can easily use.

The presence of beneficial microorganisms in liquid consortia like Azotobacter, Phosphate Solubilizing Bacteria (PSB) and Potassium Mobilizing Bacteria (KMB) improved plant growth and increased yield. When applied as a spray, these microorganisms colonized in the leaves increased the nutrient uptake and enhanced the total nutrient supply (Sharma *et al.,* 2019) [16].

The use of poultry manure, Vermicompost and liquid consortia significantly improved the growth of onion crop. The increased values for yield parameters in the study might be due to higher number of bacteria, fungi and actinomycetes found in the soil due to application of organic manures and liquid consortia, due to which higher mineralization and solubilization of nutrients occurs that provide nutrients to plants resulting in increased yield attributes and yield. These results are in close conformity of the findings of Das and Patra (2020) [5], Mishra *et al*. (2022) [10] and Rai *et al.* (2023) [14] in onion.

Quality parameters

The data regards to effect of organic manures and liquid consortia on total soluble solids chlorophyll content and pH content in bulb of onion have been presented in Table 3 Application of organic manures and liquid consortia had significant effect on quality of onion. The maximum TSS (13.45 °Brix), chlorophyll content in leaf (65.42 mg 100 g^{-1}) and minimum pH content in bulb (5.32) were found in treatment T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). While the minimum values of quality parameters were noticed under treatment T_1 (Control). Application of organic manures provides all essential elements in sufficient amount which improves the overall metabolism of plant. Availability of micro nutrients, which are required for the synthesis of various nutrient components, improves the nutritional quality of the end product. Further the accumulation of more mineral nutrient improves the dry matter and overall quality of the product. This might be because organic carbon and nutrients are easily accessible, resulting in a balanced C-N ratio that enhances produce quality. Liquid consortia increases the availability of nutrients by enhancing microbial population resulting in increased mineralization and oxidation process. The increase in TSS content might be due to enhanced synthesis and translocation of carbohydrates from leaves to bulbs. The decrease in pH content in bulb might be due to increased organic acid content in the bulb. Similar findings were also noticed by Singh (2015) [1], Kumar and Sharma (2016) [8] and Chand and Singh (2022) [3] in onion.

Economics

A keen observation of data Table 4 revealed that the application organic manures and liquid consortia on economics. The maximum net return (₹682,500 ha^{-1}) and B-C ratio (3.85) were found with the application of T_8 (50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia). However, the minimum net return (₹301,000 ha^{-1}) and B-C ratio (2.15) were found with T_1 (Control). This increased net return and B-C ratio might be due to the fact that under T_8 treatment the cost of treatments was low as compared to output added, therefore, higher bulb yields resulted in higher net returns and B-C ratio. Similar finding was recorded through use of organic manures by Deshmukh *et al.* (2019) [6], Patel (2021) [4] and Kaur and Verma (2022) [7] on onion crop.

Table 1: Effect of organic manures and liquid consortia on growth of onion

Treatments	Treatments combination	Plant height (cm)	Leaf length (cm)	Number of leaves $plant^{-1}$	Neck thickness (mm)
T_1	Control	44.86	36.75	8.24	8.75
T_2	100% RDN through FYM	51.23	41.45	9.35	9.85
T_3	50% RDN through FYM + 50% RDN through Vermicompost	53.76	42.65	10.25	10.45
T_4	50% RDN through FYM + 50% RDN through Vermicompost + Liquid Consortia	56.85	44.12	11.12	11.23
T_5	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake	52.45	41.85	9.85	10.25
T_6	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	55.32	43.65	10.75	10.95
T_7	50% RDN through Poultry manure + 50% RDN through Vermicompost	53.85	42.32	10.58	10.95
T_8	50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia	58.67	45.23	11.85	11.85
T_9	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake	54.25	42.85	10.65	10.85
T_{10}	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	57.42	44.87	11.37	11.42
	S.Em. ±	1.25	0.98	0.35	0.32
	C.D. (P=0.05)	3.72	2.92	1.04	0.95

Table 2: Effect of organic manures and liquid consortia on yield of onion

Treatments	Treatments combination	Bulb diameter (cm)	Fresh bulb weight (g)	Yield plot^{-1} (kg)	Yield (t ha^{-1})
T_1	Control	4.35	63.24	5.12	23.70
T_2	100% RDN through FYM	5.12	74.85	7.45	34.49
T_3	50% RDN through FYM + 50% RDN through Vermicompost	5.42	78.45	8.25	38.19
T_4	50% RDN through FYM + 50% RDN through Vermicompost + Liquid Consortia	5.98	88.57	9.43	43.66
T_5	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake	5.35	76.35	7.95	36.81
T_6	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	5.85	85.65	9.12	42.22
T_7	50% RDN through Poultry manure + 50% RDN through Vermicompost	5.62	82.15	8.56	39.63
T_8	50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia	6.24	92.75	9.85	45.60
T_9	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake	5.75	84.25	8.85	40.97
T_{10}	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	6.11	90.42	9.62	44.54
	S.Em. ±	0.18	2.45	0.28	1.29
	C.D. (P=0.05)	0.54	7.29	0.83	3.84

Table 3: Effect of organic manures and liquid consortia on quality of bulb of onion

Treatments	Treatments combination	TSS (°Brix)	Chlorophyll content in leaf (mg 100g-1)	pH content in bulb
T_1	Control	11.25	48.56	5.85
T_2	100% RDN through FYM	12.35	56.75	5.65
T_3	50% RDN through FYM + 50% RDN through Vermicompost	12.85	59.85	5.55
T_4	50% RDN through FYM + 50% RDN through Vermicompost + Liquid Consortia	13.18	62.74	5.42
T_5	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake	12.65	57.65	5.58
T_6	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	13.05	61.45	5.45
T_7	50% RDN through Poultry manure + 50% RDN through Vermicompost	12.95	60.85	5.48
T_8	50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia	13.45	65.42	5.32
T_9	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake	12.85	59.45	5.45
T_{10}	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	13.32	63.85	5.38
	S.Em. ±	0.24	1.65	0.06
	C.D. (P=0.05)	0.71	4.91	0.18

Table 4: Effect of organic manures and liquid consortia on net return and B-C ratio of onion

Treatments	Treatments combination	Net return (₹ ha^{-1})	B-C ratio
T_1	Control	301,000	2.15
T_2	100% RDN through FYM	472,400	2.65
T_3	50% RDN through FYM + 50% RDN through Vermicompost	535,800	2.85
T_4	50% RDN through FYM + 50% RDN through Vermicompost + Liquid Consortia	631,400	3.45
T_5	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake	508,200	2.75
T_6	50% RDN through FYM + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	605,400	3.32
T_7	50% RDN through Poultry manure + 50% RDN through Vermicompost	562,600	3.05
T_8	50% RDN through Poultry manure + 50% RDN through Vermicompost + Liquid Consortia	682,500	3.85
T_9	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake	585,400	3.15
T_{10}	50% RDN through Poultry manure + 25% RDN through Vermicompost + 25% RDN through Neemcake + Liquid Consortia	657,600	3.72
	S.Em. ±	21,450	0.22
	C.D. (P=0.05)	63,856	0.65

Conclusion

Based on the current study, "Effect of Organic Manures and Liquid Consortia on Growth, Yield, and Quality of Onion (*Allium cepa* L.)" Treatment T8 (50 percent RDN from poultry manure and 50 percent RDN from vermicompost and liquid consortiums) was proven to be substantially effective.

Therefore, treatment T_8 (50% RDN through Poultry manure

+ 50% RDN through Vermicompost + Liquid Consortia) may be recommended for onion crop to obtain superior values of growth, yield, quality parameters and increased net return of the treatments. However, this conclusion is on the basis of one year investigation further evaluation is required.

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