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Yield and Quality of Onion (*Allium cepa* L.) as Affected by Integrated Nitrogen Management

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ABSTRACT

At the Faculty of Agriculture Research Farm in Wadura, a field experiment was carried out for two consecutive Rabi seasons in 2020 and 2021 to determine the impact of integrated nitrogen management on onion (*Allium cepa* L.) yield and quality. Randomized block design (RBD) was used to set up the experiment, and the treatments were run in triplicate. When compared to other treatments, the onion yield in the plots receiving 50% N through vermicompost and 50% N through urea during Rabi 2020 and 21 was significantly higher (24.29 t ha^{-1} and 24.43 t ha^{-1}, respectively), although it was comparable to the treatment receiving 50% N through FYM and 50% through urea. The quality parameters such as ascorbic acid, total soluble solids and pyruvic acid were also found higher in treatments receiving 50 per cent nitrogen through organic sources either through farmyard manure or vermicompost.

Key words: *Nitrogen, Onion, Quality, Vermicompost, Yield.*

Introduction

One of the most significant commercial vegetable crops grown widely in India is the onion (*Allium cepa* L.), which is a member of the Alliaceae family. The onion, also known as the "Queen of the Kitchen," commands a large internal market due to its indispensable nature as a vegetable and condiment in every kitchen. Because onions contain allyl propyl disulphide, an organic molecule high in sulfur, they have a flavor and pungency that people find appealing. The mineral content of onion bulbs is high, including phosphorus, calcium, and carbohydrates. It can be utilized as dehydrated, frozen, or

fresh bulbs in many ways. The high demand for dehydrated onions lowers transportation costs and storage losses. It has multiple anticancer compounds that have been demonstrated to prevent cancer in animals.

Both organic and inorganic fertilizers have a noticeable effect on onions (Nasreen and Hossain, 2000). Consequently, using organic manures as a substitute supply of nitrogen would improve the plant's growth and output. According to Gebremichael *et al*. (2017), the continuous use of inorganic fertilizers without the addition of organic manure has led to a micronutrient shortage, an imbalance in the physico-chemical characteristics of the soil, and unsustainable crop output. For sustained onion production, the use of organic manures in the right amounts combined with chemical fertilizers enhances the general health of the soil (Gupta *et al.*, 1999). The physico-chemical qualities of soil are enhanced by organic material, including farmyard manure, and are crucial for plant growth (Snyman *et al*., 1998). Vermicomposting has shown to be a successful process for producing high-quality manure from waste materials (Sharma *et al*. 2004). According to Pandey *et al*. (2007), these organic manureal sources not only increase the availability of macro- and micronutrients, but they also cut down on the usage of chemical fertilizers and maintain soil health and production over time (Mohanty *et al*. 1992).

There's no denying that traditional fertilization techniques have improved bulb production and quality. However, it seems that standard management techniques in India are no longer able to sustain yields over the long haul. Nutrient management has been identified as a critical factor limiting sustainable onion production due to the progressive depletion of native soil fertility and the appearance of numerous nutrient deficits in onion fields (Sharma *et al*., 2003).An efficient tactic is provided by integrated nutrition management (INM) (Santhi *et al*., 2005). There is growing acceptability for a gradual transition away from pure organic fertilization and toward some inorganic fertilization. In order to find an appropriate integrated nutrient management solution for onions, this experiment was designed.

Materials and Methods

Using onions (*Allium cepa* L.) as a test crop, a field experiment was carried out at the Faculty of Agriculture Research Farm in Wadura during the Rabi season of 2020–21.The study, which included nine treatments and three replications, was set up using randomized block design (RBD). Along with the symbols employed, the specifics of the various treatments given to the onion crop are as follows:

T_1 = RDF (100:80:60) (N,P,K $kgha^{-1}$)
T_2 = 75% RDN + 25% FYM
T_3 = 50% RDN+ 50% FYM
T_4 = 25% RDN+ 75% FYM
T_5 = 75% RDN+ 25% Vermicompost
T_6 = 50% RDN+ 50% Vermicompost
T_7 = 25% RDN + 75% Vermicompost
T_8 = 50% RDN + 25% FYM + 25% Wular weed
T_9 = 50% RDN + 25% Vermicompost + 25% Wular weed

Before onions were transplanted, the soil was amended with organic material such as FYM (0.4% N, 0.2% P_2O_5, and 0.45% K_2O), vermicompost (2.1% N, 1.1% P_2O_5, and 1.4% K_2O), and wular weed (0.32% N, 0.17% P_2O_5, and 0.41 % K_2O), and let to break down at the appropriate moisture level. In every treatment, the recommended dosages of potassium and phosphorus were applied.

Results

Data related to yield as presented in table 1 depicted significant variation of various treatments. Integration of inorganic sources of nitrogen with organics showed superior results over control. Among all treatments under study, treatment T_6 where, 50% of nitrogen was supplied through urea and remaining 50% through vermicompost recorded maximum yield of 24.29 t ha^{-1} and 24.43 t ha^{-1} during rabi 2020 and 2021 respectively, and was found significantly superior over all the treatments except treatment T_3, where, 50 % Nitrogen was supplied through Urea along with 50% FYM which shows results at par. The quality parameters such as ascorbic acid, total soluble solids and pyruvic acid as presented in table 1 showed significant variations in most of the treatments. The highest ascorbic acid content of 12.06 and 12.12 mg/100g in year 2020 and 21 was found in treatment T6 where 50 per cent nitrogen was supplied through urea and 50 per cent nitrogen was supplied through vermicompost followed by treatment T3 (50% Nitrogen through urea along with 50% nitrogen through FYM) which show results at

Table 1. Effect of nitrogen management on yield and quality parameters of onion (*Allium cepa* L.).

Treatments	Yield (t ha^{-1})		Ascorbic acid (mg/100g)		Total soluble solids(°Bx)		Pyruvic acid (µ mol ml^{-1})	
	2020	2021	2020	2021	2020	2021	2020	2021
T1 = RDF (100:80:60) (N, P, K kgha^{-1})	19.45	19.68	10.06	10.22	8.55	8.69	8.67	8.74
T2 = 75% RDN+25% FYM	22.07	22.12	11.44	11.51	10.87	11.14	10.66	10.78
T3 = 50 % RDN+50% FYM	23.87	24.09	11.68	11.73	10.07	10.23	9.88	9.94
T4 = 25% RDN+75% FYM	21.21	21.42	10.54	10.64	9.23	9.45	9.07	9.16
T5 = 75% RDN+ 25% Vermicompost	22.13	22.31	11.82	11.87	11.22	11.42	10.95	11.15
T6 = 50% RDN+ 50% Vermicompost	24.29	24.43	12.06	12.12	10.54	10.73	10.22	10.41
T7 = 25% RDN+ 75% Vermicompost	21.52	21.61	10.75	10.88	9.02	9.16	9.22	9.31
T8 = 50% RDN + 25% FYM + 25% Wular weed	22.62	22.86	11.23	11.34	9.73	9.91	9.55	9.68
T9 = 50% RDN + 25% Vermicompost + 25% Wular weed	23.14	23.21	11.05	11.18	9.87	9.93	9.76	9.86
C.D.	1.13	1.18	1.23	1.12	1.59	1.56	1.06	1.07
SE(m)	0.39	0.4	0.42	0.45	0.54	0.53	0.36	0.36

par with T6 and were significantly superior over all other treatments and control.

Similarly, the highest total soluble solids and pyruvic acid content of 11.21 and 11.41 °Bx and 10.95 and 11.15 µ mol ml^{-1} in year 2020 and 2021 respectively, were found in treatment T5, where 75% of nitrogen was supplied through urea along with 25% vermicompost followed by treatment T6 (75% nitrogen through urea along with 25% vermicompost) during 2020 and 2021 respectively. Both treatments were at par and significantly superior over control.

Discussion

Under sub-optimal supply of N, onions can be severely stunted leading to decreasing bulb size and marketable yields. By contrast, too much nitrogen can result in excessive vegetative growth, delayed maturity, increased susceptibility to diseases, increase double centres in onions, reduced dry matter contents and storability, and thus decreased marketable yield and quality of onion bulbs (Sorensen and Grevsen, 2001). All of these problems have prompted people to experiment with different choices. Acceptance is growing for a gradual switch from using just organic sources to using some inorganic fertilization. To ensure the best availability of all necessary nutrients for continued crop production, integrated use of nutrients further advises that specific nutrient inputs be utilized cautiously. Keeping in view above facts the present study was undertaken and it was found that vermicompost has an advantage over farm yard manure and wular weed due to its richness in nutrients and positive impact on the physical properties of the soil. This leads to increased root activity and nutrient absorption, which in turn promotes better plant growth and superior yield attributes. It might also be explained by the fact that the applied manures, after breaking down and being mineralized, provided the plants with readily available nutrients and also had a solubilizing impact on fixed forms of nutrients (Kumar, *et al.,* 2017). Comparable increases in onion yield have been reported by Jat, *et al.,* 2018; Verma *et al.,* 2017 and Baghali *et al*. (2012) as a result of the integrated use of vermicompost and FYM with chemical fertilizer.

Improvement in quality parameters of onion due to integration of organic and inorganic sources of nitrogen could be attributed to better and balanced nutrition and production of growth promoting substances by organics which might have led to better quality via improvement in total soluble solids, vitamin A and pyruvic acid content. Improvement of quality of onion can be attributed to improvement in soil physical, chemical and biological properties which might have led to better root proliferation, improved nutrient uptake and better accumulation of photosynthates. Our findings are in accordance with the findings of other workers (Jat *et al.,* 2018; Rabari *et al.,* 2016; Diriba-Shiferaw *et al.,* 2014; Sharma, 2014; Mishu *et al.,* 2013).

Conclusion

Based on the aforementioned findings, it can be said that using organic manures (vermicompost and

FYM) in addition to chemical fertilizers can replace a plant's 25% nitrogen requirement while also greatly increasing the yield by onions when compared to using only chemical fertilizers. By applying 1.65 t ha^{-1} vermicompost and 50% of the necessary inorganic nitrogen, the experiment's results clearly show that these treatments not only increased yield (24.29 t ha^{-1} and 24.43 t ha^{-1}) during rabi 2020 and 2021 respectively, but also economically feasible. Hence, it would be reasonable to point out that 1.6 t ha^{-1} + 50% RDF N was the appropriate combination for onion production in the study area.

Conflict of Interest - None

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