The Pharma Innovation Journal 2022; 11(11): 833-839

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(11): 833-839

www.thepharmajournal.com
Received: 18-09-2022
Accepted: 26-10-2022

AP Garde
Ph.D. Research Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

SJ Shinde
Associate Professor, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

AS Kale
SRA against Assistant Professor, Department of SSAC, COA, Dongarshelaki Tanda, Udgir, Maharashtra, India

Corresponding Author:
AP Garde
Ph.D. Research Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Effect of inorganic fertilizers (NPK) with organic sources (Biomix & HA) on bulbs and roots of onion (*Allium cepa* L.)

AP Garde, SJ Shinde and AS Kale

Abstract
Present investigation was laid out in Factorial Randomized Block Design (FRBD) with three different levels of RDF; F_1: RDF 80% (80:40:40 NPK kg/ha), F_2: RDF 100% (100:50:50 NPK kg/ha) and F_3: RDF120% (120:60:60 NPK kg/ha) with six levels of organic sources *viz.,* S_0: Control, S_1: Biomix 10 kg/ha, S_2: Biomix 12.5 kg/ha, S_3: Biomix 15 kg/ha, S_4: Humic acid 05 kg/ha and S_5: Humic acid 10 kg/ha comprising eighteen treatments and replicated thrice. The higher values of bulb attributes *viz.*, polar diameter of bulb (6.48 cm), equatorial diameter of bulb (8.29 cm), number of scales per bulb (8.76) and volume of bulb (73.21 cc) was recorded under F_3: RDF 120% (120:60:60 NPK kg/ha). In organic sources humic acid 10 kg/ha level recorded higher values of bulb attributes *viz.,* polar diameter (6.06 cm), equatorial diameter of bulb (7.80 cm), number of scales per bulb (7.99) and volume of bulb (72.59 cc). In root studies, the onion produced under RDF 120% have recorded the higher values of the root parameters, *viz.*, number of roots per bulb (146.49) and root length (20.63 cm). In organic sources the maximum number of roots per bulb (143.98) and root length (19.53 cm) was recorded under humic acid 10 kg/ha.

Keywords: Fertilizers, NPK, RDF, organic sources, biomix, humic acid, bulbs, roots

Introduction
Onion (*Allium cepa* L.) is a perennial (often biennial) monocotyledonous bulbous belonging to the Alliaceae family and one of the most important crops of vegetables and spices grown under a wide range of climatic conditions worldwide (Brewster, 1994; McCallum, 2001) [10, 24].

The botanical classification of the genus *Allium* has been revised following the advancement of molecular techniques (Friesen *et al*., 2006) [13]. The most edible member of the *Allium* genus, which consists of around 780 species, is *Allium cepa* with 650 cultivars having two or more synonyms (Friesen *et al*., 2006; Fritsch and Friesen, 2002) [13, 14]. It is included in the order of Asparagales, next to Poales (which includes cereal crops), which is the second most economically important monocotyledon (Brewster, 2008; Mathew, 1996) [11, 23]. Based on their noticeable characteristics, *Allium* species of the family Alliaceae have been classified into different subgenera and sections (Hanelt, 1990) [18].

Shape, colour, single centers, skin retention, firmness, dormancy, pungency, and soluble solids concentration are important quality traits for the production of bulbs. Onion consumption has a high demand for elasticity income. Therefore, with economic growth and urbanization, increased demand for onions is expected.

In the world production of onion, India has second place after China. In the foreign exchange point of view, onion ranks first in vegetables. Yellow type onion constitutes a bulk (80%) of the world trade particularly in European market; red coloured constitutes 20% of the world trade, major share of the market being in the Asian countries. In India, only red onions are exported, and our export is limited up to 20% of the world trade. India exports the onion to U.A.E., Malaysia, erstwhile U.S.S.R., Kuwait, Sri Lanka, Singapore etc.

Onion also produces flavanols that add to the colour of the flowers, and fiber that can minimize the risk of cancer, blood clots, asthma and infection (Griffiths *et al*., 2002) [16] Historically, onions have been used in folk medicine for purposes ranging from the treatment of wounds and stomach disorders to infertility treatment (Brewster, 2008) [11]. It has also been shown that onions decrease cholesterol levels. Evidence from scientific and pharmacological studies since the Second World War has shown that onions or their derived compounds have antimicrobial and antimicrobial properties and may also be useful in the prevention or treatment of heart disease, atherosclerosis, diabetes, cancer and probably asthma (Brewster, 1994; Griffiths *et al*., 2002) [11, 16].

Baswant -780: Bulbs are flattish round in shape, red in colour, medium to large in size and mildly pungent. Total soluble solids is 11 –12%. Keeping quality is poor. Ready for harvest in 90 to 100 days after transplanting and average yield is 25 t/ha. Suitable for *kharif* season in Maharashtra. (*Anon.*, 2021).

Application of fertilizers is imperative to maintain the desired pace of crop production. It needs to be used with caution by alleviating consequent hazards in soil with the help of supplemental organic sources. Continuous use of inorganic fertilizers has depleted soil organic matter, resulting into inherent loss of native soil N, available P, available K and ultimately lowered the productions. The repeated and excessive application of chemical fertilizers is harmful to the plants. Microflora of the soil which is extremely essential for maintaining biological health, texture and structure of soil also gets affected (Sharma, 1994) [32].

Biomix is known fact that the bioagents are playing important role in plant disease management, pest management and boosting plant growth. Department of Pathology, VNMKV, Parbhani, introduced biocontrol in the region and developed experimental product in the year 2005 and he named as Biomix. A new Biomix was formulated by Dr. K.T. Apet adding some biofungicides, biopesticides and growth promoting bioagents. It contents *Trichoderma viride, Trichoderma harzianum, Asperillus niger, Pseudomonas fluorescens, Pseudomonas striata, Beauveria bassiana, Neumoria relyi, Metarhizium anisopliae, Gluconacetobactor, Paecilomyces lilacinus, Bacillus subtillis, verticillium lecanii, PPFM, Azospirillum brasilince.* After the use of Biomix the farmers are very happy. They told that, Biomix has not only solved the problems of diseases and pest but also improved the quality and yield of different vegetables with fetching highest market value. (Apet, 2018) [8].

Humic is technically not a fertilizer, although in some walks, people do consider it that, Humic is an effective agent use as a complement to synthetic or organic fertilizers. In many instances, use of Humic regularly, will reduce the need for fertilization due to the soil's and plant's ability to make better use of it. In some occurrences, fertilization can be eliminated entirely if sufficient organic material is present, and the soil can become self-sustaining through microbial processes and humus production. Whenever possible, the use of Humic with fertilizer, Humics' ability to absorb fertilizer components and increases their release to plants is well documented. The judicious use of Humic and fertilizer, will improve the performance of marginally fertile soils, of soils with low native organic matter, and of crops grown in arid regions (Chen and Aviad, 1990) [12].

So in last few years, a greater concern regarding use of organic sources as alternative/supplement/compliments to chemical fertilization has been derived to reduce the leaching and volatilization losses with high cost that inorganic fertilizers represent in agricultural production. The research work on the effect of organic sources (Biomix and Humic acid) on onion crop in India is scanty. No systematic guideline had been generated scientifically till now. Therefore, keeping all the points in view, the present study was undertaken.

Material and Methods

The present experiment entitled “Effect of different levels of fertilizers with organic sources on growth, yield and quality of onion (*Allium cepa* L.)” was conducted at Department of Horticulture, VNMKV, Parbhani in late *Kharif* season during 2020-21 and 2021-22.

There were two factors studied in this experiment one major factor A) Different levels of RDF (F_1: RDF 80% (80:40:40 NPK kg/ha), F_2: RDF 100% (100:50:50 NPK kg/ha) and F_3: RDF120% (120:60:60 NPK kg/ha)) and sub factor B) Organic sources (S_0: Control, S_1: Biomix 10 kg/ha, S_2: Biomix 12.5 kg/ha, S_3: Biomix 15 kg/ha, S_4: Humic acid 05 kg/ha and S_5: Humic acid 10 kg/ha). The experiment was laid out in Factorial Randomized Block Design (FRBD) with eighteen treatments and replicated thrice. The onions were transplanted with 15 cm row to row and 10 cm plant to plant spacing.

Treatment application

Different levels of RDF

Soil application of different levels of recommended dose of fertilizers as per the treatment for onion is i. RDF 80% (80:40:40 NPK kg/ha), ii. RDF 100% (100:50:50 NPK kg/ha) and iii. RDF 120% (120:60:60 NPK kg/ha). Nitrogen was applied as per treatment through urea, half as basal dose and remaining half in two equal splits at 10 and 30 days after transplanting. Phosphorus and potassium were applied through single super phosphate and muriate of potash respectively just before transplanting.

Organic sources

Biomix

Soil application (drenching) of different levels of biomix for onion *viz.,* i. Biomix 10 kg/ha, ii. Biomix 12.5 kg/ha and Biomix 15 kg/ha.

Procedure for preparation of biomix solution for drenching: Take 5 liter of water and add biomix quantity as per the treatment and prepared solution per plot.

Humic acid

Soil application (drenching) of different levels of humic acid for onion is i. Humic acid 5 kg/ha and ii. Humic acid 10 kg/ha.

Procedure for preparation of humic acid solution for drenching: Take humic acid quantity as per the treatment. Added in 5 liter of water per plot and mixed well.

The studies pertaining to bulb characters include polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and volume of bulb (cc).; and with regards to the root studies; numbers of roots per bulb and root length were recorded and subjected for statistical analysis as per Panse and Sukhatme (1985) [28].

Treatment evaluation/Details of observations recorded

Bulb observations

Polar diameter of bulb (cm)

Polar diameter was measured from the neck surface to the bottom root surface of

the bulb with the help of vernier calipers and thus means polar diameter was computed.

Equatorial diameter of bulb (cm)

This is the maximum distance between opposite side at right angles (to the polar diameter) and was measured by varnier calliper in cm from the same bulbs which were subjected for recording polar diameter and equatorial diameter was computed.

Number of scales per bulb

Number of scales per bulb was counted after cutting of the bulb horizontally in two halves.

Volume of bulb (cc)

Volume of bulb was recorded by measuring the displaced water which was obtained by dipping the onion bulb in a measuring cylinder and average volume was calculated in cubic centimeter (cc).

Root studies

Number of roots per bulb

Numbers of roots produced per plant were recorded from the tagged observational plants by counting the number of roots and average number of roots produced per plant was worked out.

Root length (cm)

The length of root was recorded by roots separating of five observational plants from each treatment at harvest with the help of meter scale and average was worked out and recorded as length of root in cm.

Results and Discussion

Effect on bulb attributes

The data on bulb attributes of onion vegetable as influenced by different levels of RDF with organic sources is presented in Table 1.

Effect of different levels of RDF

The studies pertaining to bulb characters include polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and volume of bulb (cc). The polar diameter of bulb, equatorial diameter of bulb, number of scales per bulb and volume of bulb significantly affected by different levels of RDF. The highest values of bulb traits *viz*., polar diameter of bulb (6.48 cm), equatorial diameter of bulb (8.29 cm), number of scales per bulb (8.76) and volume of bulb (73.21 cc) was recorded under F_3: RDF 120% (120:60:60 NPK kg/ha), followed by F_2: RDF 100% (100:50:50 NPK kg/ha). Minimum values of polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and volume of bulb (cc) were noted with application of F_1 *i.e*. (80:40:40 NPK kg/ha).

The polar and equatorial diameter of bulb was found to influence significantly due to various levels of fertilizers treatment. There was linear increase in polar and equatorial diameter of bulb due to increasing dose of fertilizers. The maximum diameter of bulb might be due to the role of nitrogen on chlorophyll, enzymes and protein synthesis and the role of phosphorus on root growth development, phosphoproteins and phospho-lipids formation and the beneficial influence of phosphorus in early stage of growth may be explained by early stimulation of root system through efficient translocation to the roots of certain growth stimulating compounds formed on account of protoplasmic activity of tops in phosphorus fed plants, which enhanced absorption of nitrogen and other nutrients and their utilization as well as the role of potassium on promotion of enzymes activity and enhancing the translocation of assimilates since an adequate supply of potassium stimulated the bulb polar and equatorial diameter of onion.

Higher nutrient availability, higher polar diameter of bulb was achieved in higher dose of RDF. These results are in agreement with those obtained by Messele (2007) who reported a significant increase in the diameter of bulbs due to application of nitrogen up to 120 kg/ha, Hafez and Geries, (2019) [17] reported that this could be due to the activities of nitrogen in different physiological and metabolic processes through increase in dry matter production, Mandal *et al*., (2020) [22] reported that this effect might be due to the dose of nitrogen (120 kg/ha) leading to increase of nutrients elements in the soil, which may increase bulb diameter during vegetative growth period, and Vairavan *et al*., (2021) [37], observed similar findings of higher bulb diameter at higher levels of fertigation. Also reported that increased dose of potassium application improves the diameter of bulbs.

The increase in number of scales per bulb due to potassium application may be due to its functional role as potassium resulting higher net photosynthetic activity. Adequate nutrient supply caused denser rooting system, which results into improvement in yield attributing characters. Since, an adequate supply of potassium stimulated number of scales per bulb.

The present trend of increase in number of scales per bulb in application of potash is in close conformity with the findings of Sharma *et al*. (1994) [32]; Amin *et al*. (1995) [3]; Singh *et al*. (1996) [33]; Singh (2000b) [35] and Yadav (2006) [40] in onion.

The highest volume of bulb observed in F_3 treatment. This might be due to nitrogen improves optimum vegetative growth and chlorophyll content in leaves which increases the mobilization and accumulation of photosynthates towards storage organs of bulbs. The results are in accordance with the findings of Singh and Dhankar (1989) [34]; Naik and Hosmani (2003) [26]; Ahmad *et al*., (2009) [1] and Godara and Mehta (2013) [15] in onion.

Effect of different levels of organic sources

The polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and volume of bulb (cc) was found influenced significantly due to various levels of organic sources. The highest polar diameter (6.06 cm), equatorial diameter of bulb (7.80 cm), number of scales per bulb (7.99) and volume of bulb (72.59 cc) was observed with humic acid 10 kg/ha level, followed by S_3. Minimum values of these all-bulb traits were recorded with control treatment.

Soil application of humic acid at 10 kg/ha recorded maximum polar and equatorial diameter of bulbs as compared to control. Application of humic acid increases the available nitrogen in soil (Sangeetha, 2003) [30], which might have improved the vegetative growth and accelerated the photosynthesis in plants and translocation of photosynthates in storage organ of bulb resulting in an increased diameter of bulb. The reduction in chlorophyll content towards maturity of the crop provides confirmity to the more accumulation of photoassimilates and stored food in bulbs. This is in conformity with the findings of Sangeetha, (2003) [30] in onion.

Significant differences were observed in number of scales per bulb of onion. The significantly more number of scales per bulb was recorded in humic acid 10 kg/ha. These may be due to the profound effect of humic acid on root. Humic acids being an important fraction of soil organic matter had a direct and indirect effect on biochemical mechanisms within the plant root. The very high ion exchange capacity of humic acid might have increased the availability of nutrients in the root zone and transfer that nutrient to leaf. Leafs are prepared food material and store in bulb and that ultimately leading to increasing number of scales per bulb of onion. The obtained results were in good agreements with Sangeetha, (2003) [30] in onion.

The significantly more volume of onion bulb was recorded in humic acid 10 kg/ha. These may be due to the profound effect of humic acid on polar, equatorial diameter of bulb, number of scales per bulb and total soluble solids in onion bulb and that ultimately leading to increasing volume of onion bulb. These perceptions are in congruity/conformity with those of Sangeetha, (2003) [30] in onion.

Table 1: Effect of different levels of RDF with organic sources on mean polar diameter, equatorial diameter, number of scales per bulb and Volume of onion bulb.

Treatment	Polar diameter of bulb (cm)	Equatorial diameter of bulb (cm)	Number of scales per bulb	Volume of bulb (cc)
Main treatment: Different levels of RDF/ha (F)				
F_1: RDF 80% (80:40:40 NPK kg/ha)	4.5	6.56	6.64	66.71
F_2: RDF 100% (100:50:50 NPK kg/ha)	5.24	6.96	7.27	69.16
F_3: RDF120% (120:60:60 NPK kg/ha)	6.48	8.29	8.76	73.21
S.E(m) ±	0.14	0.19	0.10	0.67
CD @ 5%	0.42	0.57	0.30	1.99
Sub treatment: Organic sources/ha (S)				
S_0: Control	4.76	6.38	7.13	66.52
S_1: Biomix 10 kg/ha	5.11	6.88	7.34	68.49
S_2: Biomix 12.5 kg/ha	5.45	7.51	7.57	69.76
S_3: Biomix 15 kg/ha	5.78	7.66	7.80	71.23
S_4: Humic acid 05 kg/ha	5.30	7.39	7.50	69.57
S_5: Humic acid 10 kg/ha	6.06	7.80	7.99	72.59
S.E(m) ±	0.20	0.27	0.16	0.95
CD @ 5%	0.59	0.81	0.46	2.83
Interaction effect: Different levels f RDF/ha (F) x Organic sources/ha (S)				
F_1S_0: RDF 80%/ha + Control	3.85	5.60	6.19	64.02
F_1S_1: RDF 80%/ha + Biomix 10 kg/ha	4.12	6.24	6.36	65.24
F_1S_2: RDF 80%/ha + Biomix 12.5 kg/ha	4.47	6.83	6.68	66.62
F_1S_3: RDF 80%/ha + Biomix 15 kg/ha	4.99	6.96	6.89	68.19
F_1S_4: RDF 80%/ha + Humic acid 05 kg/ha	4.26	6.70	6.64	66.58
F_1S_5: RDF 80%/ha + Humic acid 10 kg/ha	5.36	7.04	7.09	69.62
F_2S_0: RDF 100%/ha + Control	4.41	6.39	6.93	65.26
F_2S_1: RDF 100%/ha + Biomix 10 kg/ha	4.94	6.50	7.12	68.22
F_2S_2: RDF 100%/ha + Biomix 12.5 kg/ha	5.38	7.06	7.27	69.52
F_2S_3: RDF 100%/ha + Biomix 15 kg/ha	5.64	7.29	7.47	71.12
F_2S_4: RDF 100%/ha + Humic acid 05 kg/ha	5.23	6.96	7.19	68.99
F_2S_5: RDF 100%/ha + Humic acid 10 kg/ha	5.84	7.54	7.66	71.83
F_3S_0: RDF 120%/ha + Control	6.02	7.16	8.28	70.28
F_3S_1: RDF 120%/ha + Biomix 10 kg/ha	6.28	7.92	8.55	72.02
F_3S_2: RDF 120%/ha + Biomix 12.5 kg/ha	6.50	8.65	8.76	73.15
F_3S_3: RDF 120%/ha + Biomix 15 kg/ha	6.72	8.73	9.04	74.37
F_3S_4: RDF 120%/ha + Humic acid 05 kg/ha	6.41	8.50	8.69	73.13
F_3S_5: RDF 120%/ha + Humic acid 10 kg/ha	6.98	8.82	9.23	76.32
S.E(m) ±	0.35	0.47	0.24	1.64
CD @ 5%	NS	NS	NS	NS

Effect of different levels of RDF with organic sources

The interaction effect of different levels of RDF with organic sources on polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of scales per bulb and volume of bulb (cc) during pooled were found to be non-significant.

Root studies

The data on root studies of onion vegetable as influenced by different levels of RDF with organic sources is presented in Table 2.

Effect of different levels of RDF

With regards to the root studies, it was observed that, the numbers of roots per bulb and root length were significantly influenced due to different levels of RDF. The higher number of roots per bulb (146.49) and root length (20.63 cm) was recorded under F_3 (120:60:60 NPK kg/ha), followed by F_2 (100:50:50 NPK kg/ha). Minimum number of roots per bulb and root length was observed with application of 80:40:40 NPK kg/ha.

Highest number of roots per bulb were observed with RDF level F_3 (120:60:60 NPK kg/ha). It showed that application of NPK fertilizers exerted the positive effect on number of roots per bulb which may be due to the optimum availability of NPK. ‘P’ stimulates early root development and helps to establish seedling quickly. It gives rapid and vigorous start to plants. Hence, NPK fertilizer at higher dose improves the quantity of roots. The obtained results are in close conformity with those of Yadav, (2006) [40] in onion.

Root growth is stimulated by the application of nitrogen and phosphorus. Hence, the root length of the onion was increased with an increased level of RDF. These findings have been corroborated with the findings of Vairavan *et al*., (2021) [37].

Effect of different levels of organic sources

The organic sources significantly influenced the number of roots per bulb and root length. The maximum number of roots per bulb (143.98) and root length (19.53 cm) was recorded under humic acid 10 kg/ha. However, it was at par with biomix 15 kg/ha. Minimum number of roots per bulb (106.05) and root length (12.68 cm) was registered with control treatment.

Stimulation of root and shoot growth, increase in branching and root hair development of corn roots and tobacco roots when plants were grown in a nutrient solution containing humic acids (Wright and Lenssen, 2013) [39]. Humic acid 10 kg/ha recorded significantly maximum number of roots per bulb due to root proliferation is a benefit from applications of humic acids at optimum concentrations. These effects have been directly and indirectly correlated with enhanced uptake of nutrients.

Humic materials possess auxin activity, which induces rooting in plants (O'Donel 1973) [27]. Increased root growth might have been due to the formation of complexes of humic acid with Fe in plant tissues and thereby preventing the cessation of root growth (Vaughan, 1974) [38]. Beneficial effect of humic acid on root length was reported in wheat (Malik and Azam, 1985) [21]. Increased root growth might be due to the stimulation of enzyme systems by increased respiration (Syltie, 1985) [36].

The profound effect of humic acid on root length was observed due to humic acids being an important fraction of soil organic matter had a direct and selective effect on biochemical mechanisms within the plant root. The very high ion exchange capacity of humic acid might have increased the availability of nutrients in the root zone leading to enhanced root length. The obtained results are in close agreement with the finding of Sangeetha, (2003) [30] in onion.

Effect of different levels of RDF with organic sources

The interaction effect of different levels of RDF with organic sources on number of roots per bulb and root length was found to be non-significant.

Conclusion

The overall assessment of the results of present investigation on the "Effect of different levels of fertilizers with organic sources on growth, yield and quality of onion (*Allium cepa* L.)" concluded that, with increasing rate of fertilizers all the bulb and root attributing characters were increased. It was noticed that significantly highest bulb and root attributing characters was observed with the application of 120:60:60 NPK kg/ha as compared to other treatments. In organic sources maximum bulb and root attributing characters was recorded with the application of humic acid 10 kg/ha. The interaction effect of different levels of RDF with organic sources on bulb and root attributing characters was found to be non-significant.

Table 2: Effect of different levels of RDF with organic sources on mean number of roots per bulb and root length (cm) of onion

Treatment	Number of roots	Root length
Main treatment: Different levels of RDF/ha (F)		
F_1: RDF 80% (80:40:40 NPK kg/ha)	107.13	12.49
F_2: RDF 100% (100:50:50 NPK kg/ha)	126.45	16.54
F_3: RDF120% (120:60:60 NPK kg/ha)	146.49	20.63
S.E(m) ±	3.33	0.45
CD @ 5%	9.98	1.33
Sub treatment: Organic sources/ha (S)		
S_0: Control	106.05	12.68
S_1: Biomix 10 kg/ha	119.08	14.92
S_2: Biomix 12.5 kg/ha	129.86	16.94
S_3: Biomix 15 kg/ha	135.34	18.57
S_4: Humic acid 05 kg/ha	125.85	16.70
S_5: Humic acid 10 kg/ha	143.98	19.53
S.E(m) ±	4.74	0.63
CD @ 5%	14.22	1.86
Interaction effect: Different levels f RDF/ha (F) x Organic sources/ha (S)		
F_1S_0: RDF 80%/ha + Control	87.61	8.54
F_1S_1: RDF 80%/ha + Biomix 10 kg/ha	95.67	11.02
F_1S_2: RDF 80%/ha + Biomix 12.5 kg/ha	111.83	12.92
F_1S_3: RDF 80%/ha + Biomix 15 kg/ha	116.72	14.63
F_1S_4: RDF 80%/ha + Humic acid 05 kg/ha	107.92	12.42
F_1S_5: RDF 80%/ha + Humic acid 10 kg/ha	123.04	15.44
F_2S_0: RDF 100%/ha + Control	111.64	12.87
F_2S_1: RDF 100%/ha + Biomix 10 kg/ha	118.70	15.02
F_2S_2: RDF 100%/ha + Biomix 12.5 kg/ha	127.59	16.86
F_2S_3: RDF 100%/ha + Biomix 15 kg/ha	135.09	18.34
F_2S_4: RDF 100%/ha + Humic acid 05 kg/ha	122.51	16.74
F_2S_5: RDF 100%/ha + Humic acid 10 kg/ha	143.14	19.42
F_3S_0: RDF 120%/ha + Control	118.89	16.64
F_3S_1: RDF 120%/ha + Biomix 10 kg/ha	142.85	18.73
F_3S_2: RDF 120%/ha + Biomix 12.5 kg/ha	150.16	21.03
F_3S_3: RDF 120%/ha + Biomix 15 kg/ha	154.19	22.74
F_3S_4: RDF 120%/ha + Humic acid 05 kg/ha	147.10	20.93
F_3S_5: RDF 120%/ha + Humic acid 10 kg/ha	165.75	23.75
S.E(m) ±	8.21	1.1
CD @ 5%	NS	NS

References

1. Ahmad H, Al-Fraihat. Effect of different nitrogen and sulphur fertilizer levels on grfowth, yield and quality of onion (*Allium cepa* L.). Jordan Journal of Agriculture Science. 2009;5(2):155-166.
2. Aliyu U, Magaji MD, Singh A, Mohammed SG. Growth and yield of onion (*Allium cepa* L.) as influenced by nitrogen and phosphorus levels. International Journal of Agriculture Research. 2007;2(11):937-944.
3. Amin MMU, Rahim MA, Hashem MA. Influences of planting time and nitrogen on the growth and yield of onion. Bangladesh J Sci. and Industrial Res. 1995;30:275-279.
4. Anonymous. Indian Horticulture Database. Ministry of Agriculture, Government of India; c2021. www.nhb.gov.in.
5. Anonymous. Krishi Dainandini. MPKV, Rahuri; c2021.
6. Anonymous. Krishi Dainandini. VNMKV, Parbhani; c2021.
7. Anonymous; c2021. https://agritimes.co.in/amp/horticulture/indias-horticulture-crops-pro duction-estimated-331-05-mt-during-2020-21.
8. Apet KT. Biomix consortium product of bioagents. Department of Plant Pathology, College of Agriculture, VNMKV, Parbhani; c2018.
9. Bairagi P, Yadav SR, Kumar D. Response of onion (*Allium cepa* L.) to different levels of NPK and FYM under arid condition of Rajasthan. Asian Journal of Soil Science. 2015;10(1):42-46.
10. Brewster JL. Onions and other vegetable Alliums (1st ed.). Wallingford, UK: Centre for Agriculture and Bioscience International. 1994;3(01):16-21.
11. Brewster JL. Onions and other vegetable Alliums. Crop Production Science in Horticulture Series. 2008;7(15):28-32.
12. Chen Y, Aviad T. Effect of humic substances on plant growth. Humic substances in soil and crop sciences; c1990. Chapter 7. https:/doi.org/10.2136/1990.humicsubstances.c7.
13. Friesen N, Fritsch R, Nlattner FR. Phylogeny and new intrageneric classification of *Allium* (Alliaceae) based on nuclear ribosomal DNA ITS sequences. Paper presented at: Proceedings of the Third International Conference on the Comparative Biology of the Monocotyledons, (Rancho Santa Ana Botanic Garden, Claremont, California); c2006. p. 28-32
14. Fritsch RM, Friesen N. Evolution, Domestication & Taxonomy. In Allium Crop Science: Recent Advances, H.D. Rabinowitch, and L. Currah, eds. (Oxon: CABI Publishing). 2002;2(05):5-30.
15. Godara AS, Mehta RS. Response of onion (*Allium cepa* L.) to crop geometry and nitrogen levels. Progressive Horticulture. 2013;45(1):214-217.
16. Griffiths G, Trueman L, Crowther T, Thomas B, Smith, B. Onions a global benefit to health. Phytotherapy Research. 2002;1(06):603-615.
17. Hafez E, Geries L. Onion (*Allium cepa* L.) Growth, yield and economic return under different combinations of nitrogen fertilizers and agricultural biostimulants. Acta Scientific Agriculture. 2019;3(4):259-269.
18. Hanelt, P. Taxonomy, Evolution and History. Indian Journal of Agricultural Sciences. 1990;4(01):52-57.
19. Joshi RP, Rajoria UK & Bose US. Influence of nitrogen and sulphur application on growth and yield of onion. National seminar on agro technology, quality, processing and export of spices held at College of Horticulture, Mandsaur; c2005 March 20-21. p. 64.
20. Kumar A, Singh R, Chhillar RK. Influence of N and potassium application on growth, yield and nutrient uptake by onion (*Allium cepa* L.). Indian Journal of Agronomy. 2001;46(4):742-746.
21. Malik KA, Azam F. Effect of humic acid on wheat (*Triticum aestivum* L.) seed ling growth. Envt. and Expt. Botany. 1985;25:249-252.
22. Mandal J, Acharyya P, Bera R, Mohanta S. Response of Onion to NPK, S and Micronutrients. International Journal of Current Microbiology and Applied Science. 2020;9(6):1137-1144.
23. Mathew B. A Review of *Allium* section *Allium* (Royal Botanic Gardens, Kew, UK). 1996;1(05):107-113.
24. McCallum J, Leite D, Pither-Joyce M, Havey MJ. Expressed sequence markers for genetic analysis of bulb onion (*Allium cepa* L.). Theoretical and Applied Genetics. 2001;1(03):979-985.
25. Messele B. Effects of Nitrogen and Phosphorus Rates on Growth, Yield, and Quality of Onion (*Allium cepa* L.) At Menschen Für Menschen Demonstration Site, Harar, Ethiopia. Agri Res & Tech: Open Access Journal. 2016;1(3):01-08.
26. Naik BH, Hosamani RM. Effect of spacing and nitrogen levels on growth and yield of *Kharif* Onion. Karnataka Journal of Agricultural Science. 2003;16(1):98-102.
27. O'Donnel RW. The auxin like effects of humic preparation from leonardite. Soil Sci. 1973;115:106-112.
28. Panse, VG, Sukhatme PV. Statistical methods for Agricultural Workers, ICAR, New Delhi. 1985;15(2):164-168.
29. Patel ZG, Vachhani MU. Effect of NPK fertilization on the yield and quality of onion. The Horticulture Journal. 1994;7(1):75-77.
30. Sangeetha M. Effect of lignite humic acid on soil fertility, growth, yield and quality of onion. M.Sc. thesis, Tamil Nadu Agricultural University, Coimbatore; c2003.
31. Shah Saud, Yajun C, Razaq M, Luqman M, fahad S, Abdullah S, Sadiq A. Effect of Potash Levels and Row Spacings on Onion yield. Journal of Biology, Agriculture and Healthcare. 2013;3(16):118-127.
32. Sharma HR. Environment friendly input bio-fertilizers. Haryana Farming. 1994;24(6):11-12.
33. Singh H, Singh S, Singh V, Singh H, Singh S, Singh V. Response of onion to nitrogen and sulphur. Annals Agric. Res. 1996;17:441-444.
34. Singh J, Dhankar BS. Effect of nitrogen, potash and zinc on growth, yield and quality of onion. Journal of Vegetable Science. 1989;16(2):136-144.
35. Singh Janardhan, Singh T, Singh SB. Yield response of *kharif* onion grown through sets as influenced by fertility levels, planting method and weed control treatment. National symposium on Onion-garlic production and post harvest management. Challenges and strategies, NHDRF Nasik 19-21st Nov; c2000b. p. 1999.
36. Syltie PW. Effects of very small amounts of highly active biological substances on plant growth. Biol. Agr. Hort. 1985;2:245-269.
37. Vairavan C, Thiyageshwari S, Malar*vizhi* P, Saraswathi T. Response of growth, yield and quality of small onion

(*Allium cepa* L. var. aggregatum don.) to Tamil Nadu Agricultural University-Water Soluble Fertilizers (TNAU-WSF). Journal of Applied and Natural Science. 2021;13(4):1350-1356.
38. Vaughan D. A possible mechanism for humic acid action on cell elongation in root segments of *Pisum sativum* under aseptic conditions. Soil Biol. Biochem. 1974;6:241-247
39. Wright D, Lenssen AW. Humic and fulvic acids and their potential in crop production. Agriculture and Environment Extension Publications; c2013. http://lib.dr.iastate.edu/extension_ag_pubs/187.
40. Yadav DK. Integrated nutrient management in rabi onion (*Allium cepa* L.) under semi-arid condition. Ph.D. Thesis, Rajasthan Agricultural University; c2006.
41. Yadav RL, Sen NL, Yadav BL. Response of onion to nitrogen and potassium fertilization under semi-arid condition of Rajasthan. Indian Journal of Horticulture. 2003b;60(2):176-178.