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Efficacy of farmyard manure for growth and yield of onion (*Allium cepa* L.) cv. N-53

Shalini Singh and Richa Sharma

Abstract
Increasing population trend demands higher production per land to sustain human life. Green revolution is old story now and inorganic fertilizer input proven harmful in long-term impacts. Though organic farming has its long term affect in improving soil quality along with production. Present study was carried out to evaluate the response of Farm yard manure for onion cultivation and production. Different treatments were decided on the basis of nitrogen requirement by the onion crop with zero manure and 100% NPK check. Statistical analysis suggests significant (F-test at 1% & 5%) increase with increase in dose with max number of leaves (11.85), fresh weight of bulb (116.7g), with average diameter of bulb (5.6cm) suggested 0.04%, 0.46% and. 05% increase when compare to NPK production. Further reported increase in some biochemical along with bulb sulphur (5.40 ppm) without affecting soil quality.

Keywords: FYM, onion, organic, bulb, soil

Introduction
Every increasing population of the world demands the increase in food production which intern depends upon the improved agricultural practices (Soleimanzadeh and Gooshchi 2013) [31]. Onion is one of the most important commercial vegetable crops grown in India over an area covering 11.6 million hectares with a production of 17.32 tons/ha (NHRDF, Nasik 2016) [21]. Onion research in India started in 1960 at Pimpalgaon, Baswant, Nashik, but now a number of organizations including some agricultural universities are working on onion. A global review of production of major vegetables shows that India occupies second position in the onion production in world (Rai and Pandey 2007) [25] and also classified as high valued cash crop (Seran *et al*. 2010) [27] still based on demand and supply gap consumer end drifted to high prices reaches beyond the capacity of common man consumption during past few years. That leads us to take onion as our experimental crop to improve and increase its production in eco-friendly manner.

Usually excessive amounts of inorganic fertilizers are applied to vegetables crops in order to achieve a higher yield (Stewart *et al*., 2005) [33]. However, continuous usage of inorganic fertilizer such as chemical fertilizers (Neem *et al*., 2006) [20] affects soil structure and generates several deleterious effects to the environment along with human health. They should be replenished in every cultivation season because of the synthetic N, P and K fertilizer is rapidly lost by leaching in drainage water(Aisha *et al*. 2007) [2] and caused decline in organic carbon in the soil (Singh and Agrawal 2001) [30]. Expecting much from input of inorganic fertilizers is a story of past now. Some of these problems can be tackled by using bio- fertilizers, which are natural, beneficial and ecologically friendly (Soleimanzadeh and Gooshchi 2013) [31]. Organic farming reduces the cost of production by utilization of organic wastes as fertilizers which are said to be potential source for pollution unless they are used in productive and efficient way. There are evidences that organic manure found increases the nutrient status of a soil which leads to increase in onion yield (Akoun 2004) [3] although nutrient management is one of the most important considerations under organic production system (Patel *et al*,. 2005) [23].

Use of organic manures to meet the nutrient requirement of crop would be an inevitable practice in future as organic manures gradually improve the soil physical, chemical and biological properties (Prasad *et al.*, 2017) [24] along with conserving the moisture holding capacity of soil. This results in enhanced crop productivity along with maintaining the quality of crop produce (Maheswarappa *et al.*, 1999) [15]. Although organic fertilizers are lesser amount of nutrient than that of inorganic fertilizers, presence of growth promoting substances like enzymes and hormones make organic manure vital for improvement of soil fertility and productivity (Bhuma 2001) [6]. This study seeks the possibilities improving production of onion in ecological sustainable manner with complete replacement of inorganic fertilizer.

Onion (*Allium cep*a L.) originated in central Asia, which is its primary center of diversity. Though initially adapted to long days of temperate regions, it's highly cross-pollination nature has paved the way for short-day adapted selections, which are cultivated in tropical and sub-tropical conditions as in India. Onions are more prone to nutrient deficiencies than most of other crop plants because of their shallow and un branched root system thus require and often respond well to additional dose of fertilizers (Brewester 1994) [7]. Onions (*Allium cepa* L.) belong to the family Alliaceae and an important distinctive flavored crop among the vegetables and spices (Mishu *et al.*, 2013) [19]. It can be sold as 'green' (Lannoy 2001) [14] during vegetative phase and at maturity harvested as bulb (Straub and Emmett 1992) [34]. It is a good source of vitamins, minerals, polyphenols and a number of phytonutrients act as antioxidants (Griffiths *et al.*, 2002) [12] to lower blood pressure and prevent some kinds of cancer (Yang *et al.*, 2004) [36] establishes it economical as well as social importance in our day to today life. The use of FYM in improvement of quality and yield of vegetable and spices has been emphasized in recent years still there left a ground to evaluate it performance as short term benefits for onion production along with long term soil rejuvenation in environmentally friendly way. Present study is attempted to investigate dose-yield response of FYM application along with impact on soil quality.

Materials and Method

Field experiment was conducted to study the effect of Farmyard manure on the growth and yield of *Allium cepa* L. cv N-53. Doses were decided on the basis of nitrogen requirement of the plant and the amount of nitrogen present in Farmyard manure (Table 1). Plants were planted with standard spacing of 15 X 10 cm and observation were recorded for plant height, number of leaves, bulb weight, bulb diameter, plant growth rate, total chlorophyll, carotenoid, protein and sulphur. All the parameters were observed at particular intervals as per the requirement of study, Chemical and statistical analysis is conducted with standard procedure.

Results and Discussion

Organic farming or organic foods are becoming symbol of healthy living and common people are getting more and more aware about what they are consuming. Recent trends in agriculture are to shift to old time cultivation practice with proper management system with help of modern tool and technology. Peoples from elite class are willing to pay more for organic in their kitchens. Our findings suggested (table 2) positive impact on onion and increase in production with increasing dose.

Onion is a crop of green harvest as well as bulb yield. Length of leaves have it importance not only as photo-synthetically active site but also as economic point. The average maximum leaves height (fig 1) was observed in T_6 (47.87±0.41cm) followed by T_5 (46.91 cm) and T_4 (45.99 cm). Application of FYM significantly enhanced the plant height (55.83 cm) and No. of leaves (15) in Soya bean (Jain *et al.* 1995) as compare to control (9.2) and higher plant height (76.10 cm) over control (70.60 cm) in wheat (Singh and Agarwal 2001) [30].

The average number of leaves (fig 2) was noted maximum in the T_6 (11.85), followed by T_5 (11.67). Significant increase in leave number (11.05 over 9.30) is reported for FYM @ 25 t/ha (Mandoli *et al.*, 2008) [16] and for combination of FYM and VC states (13.61) leaves over 9.96 in onion (Meena *et al.*, 2015) [17], number of leaves also increases (13.61) over control (9.96) due to FYM application in onion (Reddy and Reddy 2005) [26].

The average bulb weight per plant (g) was observed (fig 3) maximum in T_6 (116.7 g) followed by T_5 (114.93 g) which surpass the effect of combine dose of FYM with NPK (Singh *et al.*, 2015) with maximum bulb weight to 110.77g in case of onion and for cucumber, fruit weight per plant increases 1.39 to 2.35 kg per plant with increasing FYM level 0-10 ton ha^{-1}(Eifediyi *et al*., 2010) [9] also.

The average dry weight of bulb per plant (g) was obtained (fig 3) maximum in T_6 (31.9 g) followed by T_5 (30.53 g). There are evidences of increase in bulb weight when FYM is applied in different combination with other inorganic fertilizer, maximum dry bulb weight of onion were found 33.3ton ha^{-1} over control 18.97 ton ha^{-1} (Yohannes *et al.*, 2013) [37], and also sole application of 25 t/ha FYM found 94.7g (Bendegumbal 2007) [5].

The average bulb diameter (fig 4) was observed maximum in T_6 (5.6 cm) cm followed by T_5 (5.4 cm) and T_4 (5.2 cm). Similar result was recorded for garlic bulb diameter (3.95cm) over control (3.53cm) (Zakari *et al.*, 2014) [38] and for onion (Fisseha1983; Soni *et el.*, 2016) [16, 32].

Maximum plant dry weight (fig 5) per plant (g) was obtained in T_6 (34.63 g) followed by T_5 (33.10 g). This result is agreement with (Nimje and Seth 1987) [22] application of FYM @ 5 t per ha recorded significantly higher dry weight per plant (75.80 g), compared to control (60.90g) in soybean.

The maximum harvest index (fig 6) observed (86.87%) in T_4followed by (86.42%) in T_2. High rate of harvest index is supported by many worker when FYM applied in combinations with other fertilizers (Tsegaye *et al.*, 2016; Abdissa *et al.*, 2011; Yohannes *et al.*, 2013) [35, 1, 37] in case of onion. Above description suggests that application of FYM increases the growth and yield parameter with increase in dose.

Onions is among miraculous vegetable consume green and bulb as well as well known for many medicinal properties. It is a good source of vitamins, minerals, polyphenols, antioxidants to lower blood pressure and prevent some kinds of cancer (Yang *et al.*, 2004) [36]. This makes its biochemical analysis as important as yield observation.

FYM application plays significant role in affecting total chlorophyll (fig 7) content in leaves of onion were superior in treatment T_4 (0.86mg/g) followed by T_5 (0.77 mg/g) than T_6 (0.73mg/g). In general it is assumed that increase in vegetative growth may enhance other parameters including biochemical but in our case we sighted decrease in chlorophyll after T_4 however observed growth and yield was more in T_5 and T_6 in comparison to T_4. Possible explanation could be given on the basis of overall amount of Chlorophyll in leave rather than estimating in mg/g as leave length and number of leaves are more in T5 and T6 than provide more photosynthetic area. FYM significantly role in affecting carotenoid content (fig 7) with maximum in treatment T_6 (2.25mg/g), followed by T_5 (2.08 mg/g). Similar type of result for combination of different organic manure is reported in Chili, protein content was recorded 0.25mg/g over control 0.14mg/g (Singh *et al.*, 2014) [29] and in Maize total chlorophyll contentwas 2.75mg/g over control 1.75mg/g (Amujoyegbe *et al.*, 2007) [4].

Bulb protein content (Fig 7) was also improved with dose as T_6 recorded maximum (1.37mg/g), followed by T_5 (1.02 mg/g). The minimum protein content was noticed with T_1 (0.75mg/g). Similarly for leaves protein (fig 7) maximum in T_6 (0.4mg/g), followed by T_5 (0.36 mg/g). Increase in protein content in end product being observed in soyabean (Devi *et al.*, 2013) [8], Chili (Singh *et al.*, 2014) [29] and Noni fruits (Kumar and Ponnuswami 2013) [13] with application of FYM in different combination. In our case dose were decided on the basis of nitrogen content in FYM. Nitrogen is associated directly and indirectly with protein synthesis as protein content increased with increasing of nitrogen doses (Erdogan *et al.*, 2010) [10] may be attributed to improve the translocation of nutrients, vitamins, protein into the bulb. Application of FYM found effective in sulphur availability to plant or may possibly enhances uptake due to improvement in bulk density of soil with supports good aeration and water holding capacity. Sulphur content (Fig 8) was maximum in T_6 (5.40ppm), followed by T_5 (5.23ppm). There are evidences of significant increase in pungency with increase in dose of organic manure in comparison to inorganic. Application of 150 % RND as FYM the pungency recorded (0.0043%) as compare to 100% RND as urea (0.0015%) (Meena *et al.*, 2014) [18].

Conclusion

Present study concludes that Farmyard Manure significantly influenced on various observed growth, yield, and biochemical parameters in comparison to control with increment in doses. Among all treatments T_6 (28 t/ha) showed optimum results. Even treatment T_5 and T_6 showed better result over inorganic (NPK) RDF.

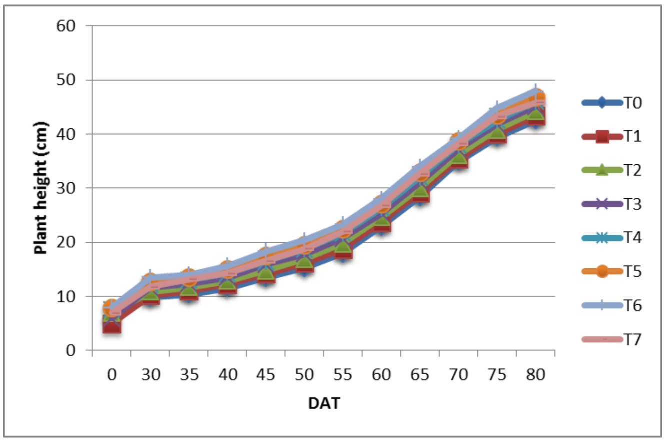

Fig 1: Effect of different doses of Farm yard manure on plant height at 60 DAT, 80 DAT and 100 DAT

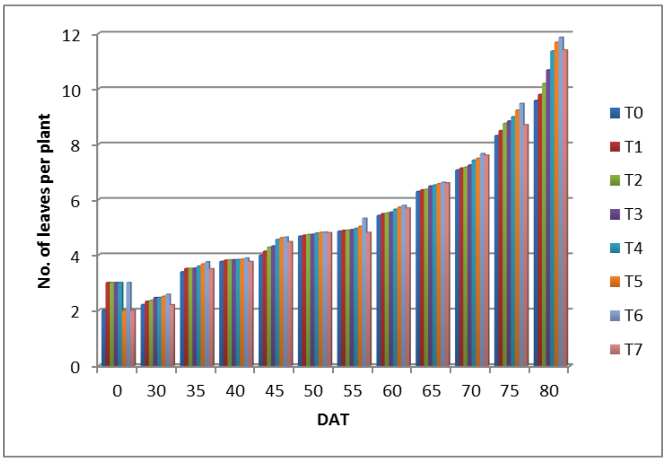

Fig 2: Effect of different doses of Farm yard manure on No. of leaves of Onion at 60 DAT, 60 DAT and 80 DAT

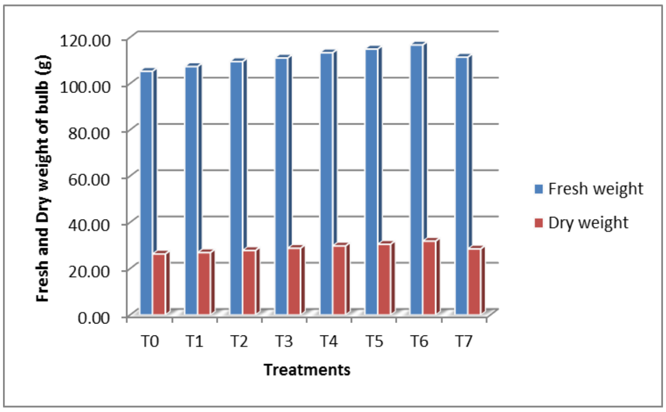

Fig 3: Effect of different doses of Farm yard manure on average fresh and dry weight (g) of Onion

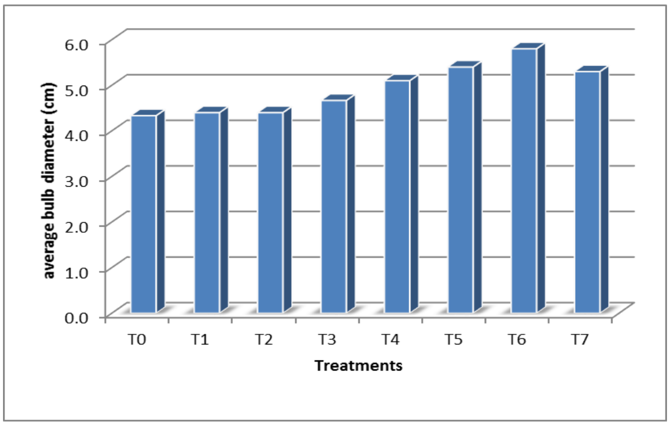

Fig 4: Effect of different doses of Farm yard manure on average bulb diameter (cm) of Onion

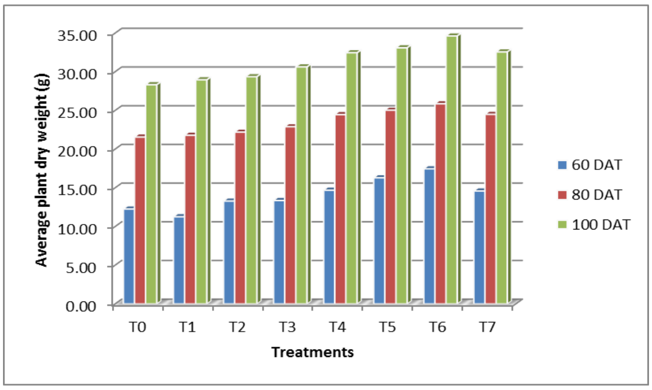

Fig 5: Effect of different doses of Farm yard manure on plant dry weight (g) of Onion at 60 DAT, 80 DAT and 100 DAT

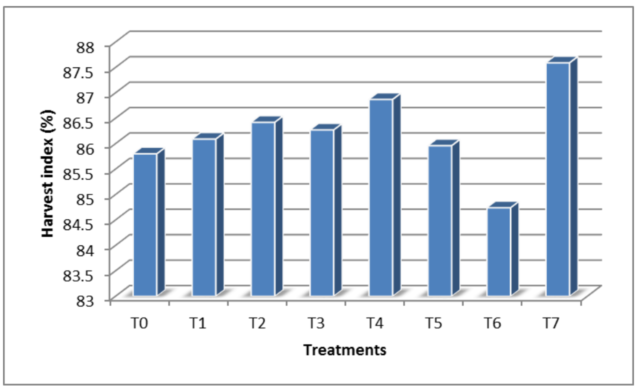

Fig 6: Effect of different doses of Farm yard manure on harvest index (%) of Onion

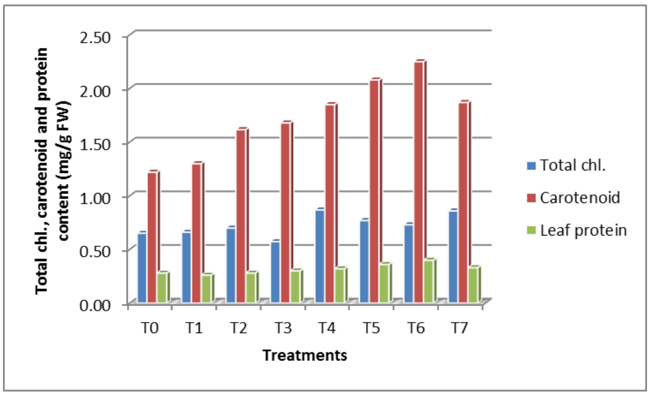

Fig 7: Effect of different doses of Farm yard manure on chlorophyll, carotenoid and protein content (mg/g FW) in leaf of Onion

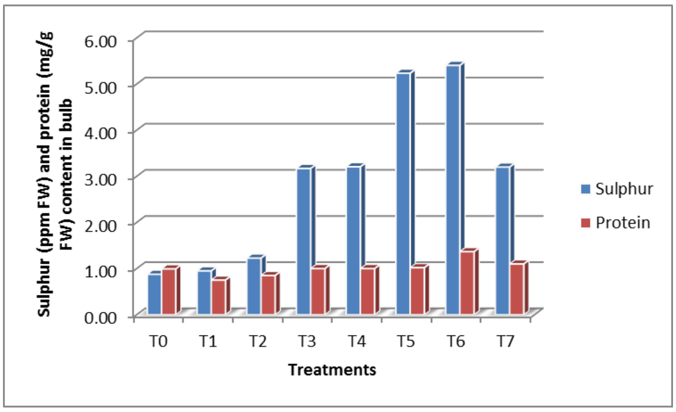

Fig 8: Effect of different doses of Farm yard manure on sulphur (ppm FW) and protein (mg/g FW) in bulb of Onion

Table 1: Treatment details

Treatment details								
Treatments	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**	**T_7**
Amount of fertilizers	Control	8 t/ha FYM	12 t/ha FYM	16t/ha FYM	20 t/ha FYM	24t/ha FYM	28t/ha FYM	100:50:100 (kg/ha) NPK
N%	0%	40%	60%	80%	100% *	120%	140%	100 % RDF

*equal to amount of nitrogen required for onion via recommended dose.

Table 2: Effects of Farmyard manure on growth, yield and biochemical parameters

Treatments	Plant Height(cm)	No. of leaves per plant	Fresh weight of bulb (g)	Dry weight of bulb (g)	Bulb diameter (cm)	Plant dry weight (g)	Harvest Index (%)	Chlorophyll (mg/g FW)	Carotenoid content (mg/g FW)	Protein (mg/g FW)	Sulphur content (ppm)
T_0	42.52±0.48	9.57±0.01	105.33	26.35	4.5	28.33	85.8	0.65	1.22	0.99	0.88
T_1	43.34±0.33	9.78±0.08	107.36	26.94	4	28.97	86.09	0.66	1.3	0.75	0.95
T_2	44.17±0.44	10.18±0.05	109.5	27.85	4.3	29.37	86.42	0.70	1.62	0.85	1.23
T_3	45.12±0.36	10.67±0.13	111.06	28.82	4.5	30.63	86.27	0.57	1.68	1	3.17
T_4	45.99±0.42	11.35±0.15	113.33	29.83	5.2	32.47	86.87	0.87	1.85	1	3.21
T_5	46.91±0.46	11.67±0.06	114.93	30.53	5.4	33.10	85.95	0.77	2.08	1.02	5.23
T_6	47.87±0.41	11.85±0.01	116.7	31.9	5.6	34.63	84.74	0.73	2.25	1.37	5.40
T_7	45.8±0.05	11.40±0.1	111.43	28.53	5.3	32.56	87.59	0.86	1.87	1.1	3.20

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