

# Effect of different varieties and FYM levels on yield and quality of onion (*Allium cepa* L.) in arid western Rajasthan

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## Abstract:

An experiment was conducted during *rabi* season of 2009-2010 at Horticulture Farm, Swami Keshwanand Rajasthan Agricultural University, Bikaner. The experiment comprising of four varieties of onion viz., PDR, RO-59, RO-252 and RO-282 and FYM levels viz., 0, 20, 40 and 60 t ha<sup>-1</sup>. A total of 16 treatment combinations were evaluated in randomized block design with three replications. The results indicated that plant height, number of leaves per plant, moisture content of bulb, neck thickness, diameter of bulb, volume of bulb, bulb yield, TSS and N, P and K uptake were maximum under the variety RO-252. Application of FYM @ 40 t/ha significantly increased number of leaves per plant, moisture content of bulb, neck thickness, diameter of bulb, volume of bulb, bulb yield, TSS, Pungency and N, P and K content and uptake however, plant height at 60 DAT was maximum with the application of 60 t FYM/ha.

**Key words:** *Bulb, Farm Yard Manure, moisture, onion, varieties and volume.*

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## Introduction

Onion (*Allium cepa* L.) is one of the commonest and indispensable vegetable cum condiment crop grown for local consumption, export and processing and is used as salad and cooked in various ways in all curries, fried, boiled, baked, soup making and in pickles. Soils of Western Rajasthan, particularly in Bikaner district, contain very low clay (4-6%) and organic matter (0.08%), N (0.50%), P (0.25%) and K (0.50%). Farmyard manure rich in organic matter can be supplemented with N, P and K fertilizers. FYM not only provides most of the essential plant nutrients but also improves soil structure through binding effect on soil aggregates, Cation exchange capacity, water holding capacity, fertilizers use efficiency, microbial activity and nutrient availability in soil. Farm yard manure with chemical fertilizers and their method of application help in improving the fertility and productivity and physical condition of soil (Abusaleha and Shamugvelu, 1998). Among the various factors responsible for higher yield potential, the application of adequate quantities of Farm Yard Manure is considered as one of the most effective way to boosting the crop yield (Mohanty and Prusti, 2001 and Singh *et al.* 1995) in soils of western Rajasthan. The main

reason for low productivity is lack of suitable varieties for cultivation in arid areas. Most of the farmers are illiterate and always remain under confusion about recommended varieties. One of the important aspects of improvement in yield and quality of onion is the selection of suitable cultivars to a particular agro-climatic region.

## Material and methods

The experiment was conducted on loamy sand soil at Horticulture Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner, during *Rabi* season 2009-2010. The experiment comprising four varieties of onion viz., PDR, RO-59, RO-252 and RO-282 and FYM levels viz., 0, 20, 40 and 60 t/ha. A total of 16 treatment combinations were evaluated in randomized block design with three replications. The seven week old seedlings of four varieties of onion viz., PDR, RO-59, RO-252 and RO-282 were transplanted with spacing of 15 x 10 cm in second December 2009. The irrigation was applied through drip system consisted of 16 mm laterals having drippers at 40 cm distance. Each plot consisted of 3 laterals at 80 cm apart and four rows of onion were planted at each lateral. As per treatment FYM was applied at the time of field

preparation and chemical fertilizers i.e. nitrogen, phosphorus and potassium (100, 50 and 100 kg/ha) were applied through Urea, DAP and MOP.

## Result and Discussion

### Effect of varieties

Among different varieties, RO-252 produced significantly higher plant height and maximum number of leaves per plant at 60 days after transplanting over rest of the varieties (Table 1). Plant height and number of leaves per plant are the genetic characters and hence different varieties varied with respect to these characters which ultimately brought about variation in these characters. This finding corroborate with the results of Mohanty and Prusti (2001). RO-252 variety produced significantly higher moisture content of bulb. This might be due to characteristics of this variety that increased vegetative growth in terms of plant height and number of leaves per plant which resulted in higher moisture content of bulb. These characters play a vital role in various metabolic processes primarily that results in increased net photosynthesis and helps in the translocation of photosynthates in storage organ of bulb resulting in increased weight of bulb. Diameter and volume of bulb and bulb yield were found significantly higher in RO-252 however, significantly lesser neck thickness was found in same variety. This might be due to characteristics of these varieties that increased vegetative growth with extended frame work of plant. The bulb yield, being primary functions of cumulative effect of these parameters. Improved fresh weight of leaves and bulb with varietal characters leading to significant improvement in bulb yield and resulted in better source and sink relationship. Similar results were observed by Khar *et al.* (2007) in onion. Allyl-propyl disulphide was recorded highest in PDR variety than the other varieties of onion (Table 2). This might be due to characteristics of this variety that slightly increased trend leads to increase of volatile and fatty oil content resulting in significantly higher production of allyl-propyl disulphide in onion bulbs. Increased in allyl-propyl disulphide with variety PDR was in close agreement with those of Abbey *et al.* (2005) in onion. Highest TSS content (12.03 °Brix) was recorded in RO-252 variety of onion followed by RO-59, RO-282 and PDR which was 2.82, 2.99 and 6.64 per cent higher over RO-59, RO-282 and PDR, respectively. However, there was non-significant difference observed between RO-59 and RO-282. The varietal character increased total soluble solids, nitrogen, phosphorus and potassium content and uptake which were found maximum in RO-252. This might be due to vigorous vegetative growth and imparts deep green colour of the foliage which favoured photosynthetic activity of the plants. Due to this there was

greater accumulation of food material i.e. carbohydrate in the bulb. There was more synthesis of T.S.S. Similar observations were also reported by Khar *et al.* (2007) and Zhong *et al.* (1997) in onion.

### Effect of FYM

The maximum plant height at 60 DAT was observed with the application of 60 tonnes FYM (Table 1). However, the maximum number of leaves per plant were recorded with FYM 40 t/ha. This might be due to the fact that application of FYM resulted in vigorous vegetative growth of the plant and imparted dark green colour to the foliage which favoured photosynthetic activity of the plant and greater synthesis of carbohydrate in the leaves leading to formation of amino acids, nucleo-proteins, chlorophyll, alkaloids and amides. These complex compounds are responsible for building up of new tissues and are associated with a number of metabolic processes, which in turn favoured better development of plant. These results are in agreement with the findings of Rafi *et al.* (2002) in tomato, Ghuge *et al.* (2007) also observed better growth in cabbage with organic manure application. Mallangouda *et al.* (1995) reported application of FYM and NPK improved plant height and number of branches in chilli. Manolika *et al.* (2007) reported that the application of farm yard manure 40 t/ha along with 50% RDF produced maximum height of plant in tomato.

In general, the significant improvement in yield attributes of onion with the farm yard manure could be ascribed to overall improvement in vigour and crop growth as already explained in preceding paragraphs. Since an adequate and small amount of major nutrients supplied through FYM in the life of a plant is considered important in promoting rapid fresh weight and dry weight of bulb in terms of bulb size, diameter of bulb, volume of bulb and bulb yield. These parameters were recorded significantly higher with application of 40 tonnes FYM per hectare. FYM coupled with increased net photosynthesis and helps in the translocation of photosynthates in storage organ of bulb resulted in increased diameter and weight of bulbs (Singh *et al.* 1995 and Mallangouda *et al.* 1995). The bulb yield being a primarily function of cumulative effect of these parameters, significantly increased by 315.17 q/ha with FYM at 40 t/ha.

The beneficial effects of farm yard manure on yield attributes were probably due to enhanced supply of macro as well as micronutrients during entire growing season. It might have attributed to higher manufacture of food and its subsequent partitioning in sink. The availability and supply of nutrients to plants favourably influenced the flowering and fruit formation, ultimately increased the bulb yield. The FYM might enhance the efficiency of uptake of native and soil nutrients. The reason for increased bulb yield with the

application of farm yard manure could be attributed to solubilization effect of plant nutrients by the addition of FYM leading to increased uptake of nutrients especially NPK as reported by Raina and Jaggi (2008) in onion and Singh and Janardan (2004) in potato. The improvement in bulb weight and yield of onion in response to farm yard manure application is possibly attributed to improved soil physical conditions and slow release availability of nutrients (Dimri and Singh, 2005).

The application of farm yard manure up to 40 t/ha significantly increased the total soluble solids (TSS) content in comparison to control and other doses of FYM (Table 2). The maximum TSS in bulb was recorded with FYM @ 40 t/ha. The improvement in TSS might be due to the known fact that organic manures (farm yard manures) are capable of supplying adequate macro and micro plant nutrients which play a major role in quality improvement through desirable enzymatic changes taking place during growth. Higher nutrient contents in leaves and bulb also seems to be attributed to higher functional activity of roots for lower duration under this treatment. Similar results were obtained by Gupta *et al.* (1999) and Bairwa *et al.* (2009). The pungency of onion increased with the increasing doses of FYM up to 60 t/ha than the control. The increase in

pungency of onion at higher level of FYM was due to increase in synthesis and translocation of sulphur to the onion (Raina and Jaggi, 2008).

Application of 40 t FYM/ha significantly increased the nitrogen, phosphorus and potassium contents and uptake in plants over its lower doses but remained at par with 60 t FYM/ha. The positive influence of FYM on N, P and K contents in plants was due to improved nutritional environment in the dense root zone of the plants. Thus adequate supply of FYM early in the crop season resulted in greater availability of nutrients including N, P and K in particular root zone. Nutrient availability increased in the root zone coupled with increased metabolic activity at the cellular level might have increased the nutrients uptake and accumulation in vegetative plant parts. The NPK uptake increased under organic treatments as compared to control. The probable reason for this increase was that, sources of organic manures applied to onion might have improved nutrient availability in soil and thus benefited the crop. Secondly, higher bulb yield obtained with organic sources also resulted in better uptake of nutrients from soil. Higher uptake at maximum fertility level might be due to more nutrient content and yields which removed more nutrients from soil (Sarkar and Mondal, 2005).

Table 1. Effect of varieties and FYM levels on growth and yield of onion.

Treatments	Plant height (cm) at 60 DAS	No. of leaves per plant at 60 DAS	Moisture content of bulb (%)	Neck thickness (cm)	Diameter of bulb (cm)	Volume of bulb (cc)	Bulb yield (q ha <sup>-1</sup> )
Varieties							
PDR (V <sub>1</sub> )	54.45	6.5	11.27	1.53	4.69	53.73	251.88
RO-59 (V <sub>2</sub> )	54.43	6.85	15.99	2.01	5.06	55.58	268.14
RO-252 (V <sub>3</sub> )	56.17	7.15	18.21	2.28	5.34	57.98	290.49
RO-282 (V <sub>4</sub> )	53.98	7.05	16.39	2.13	5.22	54.90	258.39
S. Em ±	0.51	0.07	0.43	0.04	0.10	0.80	5.63
C.D. at 5%	1.48	0.21	1.25	0.11	0.28	2.31	16.27
Levels of FYM (t/ha)							
Control (F <sub>0</sub> )	51.87	6.53	13.2	1.64	3.68	40.78	182.18
20 (F <sub>1</sub> )	53.7	6.7	15.13	1.94	4.63	55.13	242.01
40 (F <sub>2</sub> )	55.53	7.07	16.26	2.14	5.87	62.47	315.17
60 (F <sub>3</sub> )	57.93	7.25	17.27	2.23	6.13	63.82	329.53
S. Em ±	0.51	0.07	0.43	0.04	0.10	0.80	5.63
C.D. at 5%	1.48	0.21	1.25	0.11	0.28	2.31	16.27

Table 2. Effect of varieties and FYM levels on quality parameters of onion

Treatments	TSS (°Brix)	Allyl-propyl disulphide content (mg/100g)	Nutrient content (%)			Nutrient uptake (kg/ha)		
			Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
Varieties								
PDR (V <sub>1</sub> )	11.28	5.59	0.860	0.581	0.985	23.92	16.30	27.36
RO-59 (V <sub>2</sub> )	11.70	5.34	0.879	0.628	0.979	25.94	18.64	28.80
RO-252 (V <sub>3</sub> )	12.03	5.32	0.880	0.646	0.992	27.92	20.51	31.45
RO-282 (V <sub>4</sub> )	11.68	5.44	0.865	0.654	0.995	24.72	18.71	28.28
S. Em ±	0.11	0.05	0.005	0.007	0.002	0.55	0.43	0.55
C.D. at 5%	0.31	0.15	0.013	0.021	0.006	1.60	1.25	1.59
Levels of FYM (t/ha)								
Control (F <sub>0</sub> )	10.98	5.18	0.843	0.586	0.974	17.44	12.14	20.12
20 (F <sub>1</sub> )	11.53	5.37	0.862	0.621	0.984	23.04	16.60	26.27
40 (F <sub>2</sub> )	11.94	5.51	0.887	0.648	0.996	30.29	22.11	33.96
60 (F <sub>3</sub> )	12.23	5.62	0.891	0.654	0.998	31.73	23.31	35.54
S. Em ±	0.11	0.05	0.005	0.007	0.002	0.55	0.43	0.55
C.D. at 5%	0.31	0.15	0.013	0.021	0.006	1.60	1.25	1.59

## References

- Abbey, L., Joyce, D. C., Aked, J. and Smith, B. 2005. Evaluation of eight spring onion genotypes, sulphur nutrition and soil-type effects with an electronic nose. *Journal of Horticultural Science & Biotechnology*, 80(3) : 375 – 381.
- Abusaleha and Shanmugavelu, K.G. 1998. Studies on the effect of organic v/s. inorganic sources of nitrogen on growth, yield and quality of okra [*Abelmoschus esculentus* (L.) Moench]. *Indian Journal of Horticulture*, 45(2) : 312 – 318.
- Bairwa, H. L., Shukla, A. K. Mahawer, L. N., Kaushik, R. A., Shukla, K. B. and Ameta, K. D. 2009. Response of integrated nutrient management on yield, quality and physio-chemical characteristics of okra cv. Arka Anamika. *Indian Journal of Horticulture*, 66(3) : 310 – 314.
- Dimri, D.C. and Singh V.P. 2005. Response of farm yard manure, nitrogen and row spacing on bulb weight and yield of onion (*Allium cepa* L.) cv. VL-3. *Progressive Horticulture*, 37(1) : 185 – 187.
- Ghugre, T.D., Gore, A.K. and Jadhav, S.B. 2007. Effect of organic and inorganic nutrient sources on growth, yield and quality of cabbage (*Brassica oleracea* var. *capitata*). *Journal of Soil and Crops*, 17: 89 – 92.
- Gupta, R. P., Sharma, V. P., Singh, D. K. and Srivastava, K. J. 1999. Effect of organic manure and inorganic fertilizer on growth, yield and quality of onion cv. Agri Found Dark Red. *News letter – National Horticultural Research and Development Foundation*, 19 (2/3) : 7 – 11.
- Khar, A., Devi, A., Asha, Mahajan, V. and Lawande, K. E. 2007. Stability analysis of some elite onion lines in late kharif season. *Indian Journal of Horticulture*, 64: 32-36.
- Mallangouda, B., Sulikeri, G.S., Murthy, B.G. and Patibha, N.C. 1995. Effect of NPK, FYM and companion crops on growth, yield and yield component of chilli (*Capsicum annum* L.). *Adv. Agril. Res. India*, 3: 58 – 59.
- Manolihar, R. R., Vitkar, M. N., Vasmate, S. D., Patil, R. F. and Kalalbandi, B.M. 2007. Effect of integrated nutrient management on growth and yield of tomato (*Lycopersicon esculentum* Mill.). *The Asian Journal of Horticulture*, 2: 178 – 180.
- Mohanty, B.K. and Prusti, A.M. 2001. Performance of common onion varieties in kharif seasons. *Indian Journal of Tropical Agriculture*, 39: 21 – 23.
- Rafi, Mohmad, Narwadkar, P.R., Prabhu, T. and Sajindranath, A.K. 2002. Effect of organic and inorganic fertilizers on growth and yield of tomato

- (*Lycopersicon esculentum* Mill). *South Indian Hort.*, 50(4-6): 522 – 526.
- Raina, S.K. and Jaggi, R.C. 2008. Effect of sulphur in presence and absence of farm yard manure on onion (*Allium cepa* L.) under onion-maize (*Zea mays*) cropping sequence. *Indian Journal of Agriculture Sciences*, 78(8) : 659 – 662.
- Sarkar, B. and Mondal, S.S. 2005. Effect of integrated nutrient management on the growth and productivity of potato (*Solanum tuberosum*). *Environment and Ecology*, 23(3): 387 – 391.
- Singh, S. K. and Janardan, J. 2004. Effect of organic and inorganic sources of nutrition on productivity, economics and nutrient uptake of potato. First Indian Horticulture Congress held at New Delhi. *Abstracts*. pp. 260.
- Singh, V., Singh R. K. and Singh, V. 1995. Response of onion (*Allium cepa* L.) to N, P, Zn and FYM. *Annals of Agricultural Research*, 16: 79 – 81.
- Zhong Song, Zhang Dipei, Weiyouying, Li-Ji Rong, Sun Hejun and Zhang, S. 1997. Analysis of soluble solids, dry matter, soluble sugar and ethereal oil in welsh onion (*Allium fistulosum* L.). *Journal of Shandong Agricultural University*, 28: 2477 – 2482