

GROWTH, YIELD AND ECONOMICS FROM ORGANICALLY PRODUCED ONION CULTIVARS

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ABSTRACT

A field experiment was conducted during rabi seasons of 2011-12 and 2012-13 at the nursery of Department of Horticulture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) to study the growth, yield and economics from the organically produced onion cultivars. Results revealed that the Agrifound Dark Red cultivar recorded maximum growth parameters (plant height 53.64 cm, leaves 9.96/plant, leaf length 41.09 cm, neck diameter 2.13 cm and DM of plant 12.90 g) and yield attributes (fresh weight of bulb 61.58 g, dry weight of bulb 10.67 g, diameter of bulb 7.14 cm and length of bulb 8.23 cm) as compared to Nasik Red. Agrifound Dark Red produced higher bulb yield (39.34 t ha^{-1}) and net income ($\text{₹ } 107263 \text{ ha}^{-1}$) than Nasik red. Application of 100% RDF ($N_{150}P_{80}K_{80}$) resulted in significantly higher growth parameters, yield attributes, consequently bulb yield (43.76 t ha^{-1}) and net income ($\text{₹ } 146193 \text{ ha}^{-1}$). Vermicompost produced lower bulb yield than FYM but the net income was higher with vermicompost. Among organics, poultry manure produced lowest bulb yield and net returns. Yield of onion bulb with 10 t FYM ha^{-1} or 4 t vermicompost ha^{-1} was relatively lower than 100% NPK under the existing agro-climatic conditions of the region.

Key words: Organically produced, onion cultivars, economics, yield

INTRODUCTION

Onion (*Allivum cepa* L.) commonly known as pyaz is a major bulbous crop of global importance. It is an important commercial vegetable crop. In M.P. it is occupying an area of 57.3 thousand ha with production upto 952 thousand tonnes and productivity $16.6 \text{ tonnes ha}^{-1}$ (Anonymous, 2010). Organic farming for sustainable crop yield is the burning issue of the present day. The long term use of chemical fertilizers is known to degrade physico-chemical and biological properties of soil. The use of farmyard manure, vermicompost, poultry manure compost etc. improves the soil properties, mitigates short supply of micronutrients, stimulates the proliferation of diverse group of soil micro-organism and plays an important role in the maintenance of soil fertility and improves the ecological balance of rhizosphere (Verna *et al.*, 2014). Worm casts contain five times more N, seven times more P and 11 times more than ordinary soil, the main minerals needed for plant growth. Vermicompost application to different field crops has been known to reduce the requirement of chemical fertilizers without any reduction in crop yield (Giraddi, 2000). Organic manures viz, FYM, poultry and pig manures are the store-house of plant nutrients (Channabasavanna and Biradar, 2002). So far no work has been done on organically produced onion cultivars in Kymore plateau of M.P.; hence the present experiment was taken up using onion as test crop.

MATERIALS AND METHODS

The field experiment was conducted during rabi seasons of 2011-12 and 2012-13 at the

Horticulture Nursery, RVSKVV College of Agriculture, Gwalior (M.P.) The soil of the experimental area was sandy-loam having pH 7.9, electrical conductivity 0.13 dS m^{-1} , organic carbon 4.7 g kg^{-1} , available N, P_2O_5 and K_2O 214, 15 and 283 kg ha^{-1} , respectively. The rainfall received during the crop season was 54 and 205 mm in 2011-12 and 2012-13, respectively. The treatments comprised two cultivars (Agrifound Dark Red and Nasik Red) and ten organic and inorganic nutrient sources (2, 3 and 4 t vermicompost ha^{-1} ; 6, 8 and 10 t FYM ha^{-1} ; 1.5, 2.5 and 3.5 t poultry manure ha^{-1} and 100 % RDF ($N_{150}P_{80}K_{80}$). The experiment was laid out in randomised block design (factorial) with three replications. The 45 day old seedlings of onion cultivars were transplanted 17 October in both the years keeping 15 cm x 10 cm planting geometry. The 100 % RDF ($N_{150}P_{80}K_{80}$) was applied through urea, single superphosphate and muriate of potash, respectively. The crop was grown as per recommended package of practices. The crop was harvested on 29th March in the respective years. Observations were recorded on growth and yield attributes and yield. The economics of the various treatments was calculated as per existing market rates of inputs and the produce.

RESULTS AND DISCUSSION

Growth parameters

Agrifound Dark Red cultivar resulted in significantly higher plant height (53.64 cm), leaves (9.96/plant), leaf length (41.09 cm), neck diameter (2.13 cm) and DM of plant (12.90 g) as compared to Nasik Red. Such variations are due to the fact that

these parameters are mainly governed genetically owing to the variability in their parental origin. Similar results were reported by Das *et al.* (2015). Out of organic and inorganic fertilizer, 100% RDF ($N_{150}P_{80}K_{80}$) brought about significantly higher plant height (56.28 cm), leaves (11.95 / plant), leaf length (49.76 cm), neck diameter (2.86 cm) and DM of plant (15.35 g). The second best nutrient treatment encouraging plant growth was 10 t FYM ha^{-1} followed by 8 t FYM ha^{-1} and 4 t VC or 6 t FYM ha^{-1} . The significant increase in growth parameters of onion due to NPK nutrition might be owing to the better availability of nutrients and effective conversion of multi-nutrients at the site of photosynthesis into pigments (Singh *et al.*, 2011 and Verma *et al.* 2014). In fact the combined function of N, P and K might have produced maximum photosynthate accumulation towards leaf biomass, because during initial stage, leaf is the most powerful sink than any other plant parts in the most of the crops. In fact leaf is the factory for the conversion of

solar energy into the chemical energy by the process of photosynthesis. The diminishing response of onion to different organics (FYM, vermicompost and poultry manure) as compared to NPK fertilizers may be due to variation in their nutrient composition and delay in their nutrient release pattern for the actively growing plants. Out of organics, FYM performed the best, followed by vermicompost and poultry manure with respect to growth characters. The higher growth parameters due to FYM over other organics may be owing to the fact that FYM is the cattle manure having multiple plant nutrients in their more beneficial proportion and availability for better plant growth and development. Vermicompost and poultry manure were less effective for growth characters which may be due to variation in their nutrient composition, decomposition and nutrient release to the growing plants. These results corroborate with those of Jawadagi *et al.* (2012), Jamir *et al.* (2013), Latha and Sharanappa (2014).

Table 1: Growth parameters of onion as influenced by onion cultivars and organic sources of nutrients (mean of 2 years)

Treatments	Plant height (cm) (120 DAT)	Leaves/ plant (90 DAT)	Leaf length (cm) (90 DAT)	Neck diameter (cm) (120 DAT)	Dry matter of plant (g) (120 DAT)
Cultivars					
Nasik Red	53.0	9.7	40.8	2.0	12.62
Agrifound Dark Red	53.6	9.9	41.0	2.1	12.90
CD (P=0.05)	0.09	0.12	0.12	0.04	0.23
Nutrient levels					
2 t VC ha^{-1}	50.7	8.9	38.8	1.8	11.74
3 t VC ha^{-1}	53.1	9.6	40.2	2.0	12.08
4 t VC ha^{-1}	53.8	10.1	40.4	2.0	12.64
6 FYM t ha^{-1}	53.4	9.9	41.8	2.0	12.48
8 FYM t ha^{-1}	54.6	10.7	43.7	2.0	14.05
10 FYM t ha^{-1}	55.9	10.9	46.5	2.2	14.18
1.5 PM t ha^{-1}	50.9	7.7	33.9	1.8	10.75
2.5 PM t ha^{-1}	52.1	9.1	36.4	1.9	11.84
3.5 PM t ha^{-1}	52.4	9.3	37.9	2.0	12.48
100% ($N_{150}P_{80}K_{80}$)	56.3	11.9	49.7	2.9	15.35
CD (P=0.05)	0.19	0.26	0.26	0.08	0.53

Yield attributes

Agrifound Dark Red recorded non-significantly higher fresh weight of bulb (61.58 g), dry weight of bulb (10.67 g), diameter of bulb (7.14 cm) and length of bulb (8.23 cm) as compared to Nasik Red. The overall trend of yield attributes under different varieties may be attributed exactly in accordance with the increase in plant growth parameters. Agrifound Dark Red attained the maximum growth parameters, hence resulted in

maximum yield (Das *et al.* 2015). Application of 100% RDF ($N_{150}P_{80}K_{80}$) brought about almost significantly higher yield attributes over the other treatments. However, 10 t FYM ha^{-1} performed equally well with respect to dry weight of bulb and bulb length. This was followed by 8 t FYM ha^{-1} and 4 t VC ha^{-1} . The lowest yield attributes were recorded under 1.5 t PM ha^{-1} . The cumulative functions of N, P and K nutrients caused increased photosynthates and its better utilization thereby better growth and

Table 2: Effect of cultivars and sources of nutrients on yield attributes, yield and economics of onion (mean of 2 years)

Treatments	Fresh weight of bulb (g)	Dry weight of bulb (g)	Bulb diameter (cm)	Bulb length (cm)	Bulb yield (t ha ⁻¹)	Net income (₹ ha ⁻¹)	B:C ratio
Cultivars							
Nasik Red	61.00	10.37	6.8	8.0	37.95	99873	2.15
Agrifound Dark Red	61.58	10.67	7.1	8.2	39.34	107263	2.22
CD (P=0.05)	NS	NS	NS	NS	0.36	-	-
Nutrient levels							
2 t VC ha ⁻¹	56.58	9.83	6.8	7.9	36.03	102368	2.32
3 t VC ha ⁻¹	59.22	10.72	6.9	8.1	37.97	107068	2.30
4 t VC ha ⁻¹	64.39	10.91	7.0	8.2	39.42	109330	2.25
6 FYM t ha ⁻¹	59.47	10.77	7.0	8.1	38.41	100268	2.10
8 FYM t ha ⁻¹	65.21	10.90	7.0	8.3	40.36	104180	2.05
10 FYM t ha ⁻¹	66.53	11.09	7.1	8.3	42.58	104355	1.97
1.5 PM t ha ⁻¹	56.45	9.54	6.8	7.8	34.60	90218	2.09
2.5 PM t ha ⁻¹	57.63	9.92	6.8	7.9	36.05	87818	1.95
3.5 PM t ha ⁻¹	59.00	10.37	6.9	8.0	37.08	83880	1.82
100% (N ₁₅₀ P ₈₀ K ₈₀)	68.41	11.19	7.4	8.5	43.76	146193	3.01
CD (P=0.05)	0.53	0.26	0.26	0.26	0.80	-	-

development. The significant variation in yield attributes due to different organics might be owing to variations in their nutrient composition, decomposition, C:N ratio and nutrient release pattern which resulted in differences in growth parameters and translocation of photosynthates towards the reproductive organs (Reddy *et al.*, 2011 and Jamir *et al.*, 2013).

Productivity and economics

The fresh yield of Agrifound Dark Red onion was found significantly higher (39.34 t ha⁻¹) over Nasik Red (37.95 t ha⁻¹). This may be owing to increased yield attributes in Agrifound Dark Red. Consequently the net income was maximum (Rs.107263 ha⁻¹) from Agrifound Dark Red over Nasik Red (₹ 99873 ha⁻¹). The B:C ratio ranged from 2.15 to 2.22. This might be owing to greater yield produced by Agrifound Dark Red cultivar. Similar results were reported by Das *et al.* 2015. Application of 100% RDF recorded significantly higher fresh yield of onion (43.76 t ha⁻¹) as compared to all the organic sources of nutrients. Consequently, the net income was ₹ 146193 ha⁻¹ with B:C ratio 3.01. The second and third best nutrient treatments

were 10 and 8 t FYM ha⁻¹ producing 42.58 and 40.36 t ha⁻¹ onion yield with ₹ 104355 and ₹ 104180 ha⁻¹ net income, respectively. This was due to lower yield over 100% RDF. However, 4 t VC ha⁻¹ performed the fourth best in yield (39.42 t ha⁻¹) and second best in net income (₹ 109330 ha⁻¹). The third best net income Rs.107068 ha⁻¹ was obtained from 3 t VC ha⁻¹. The levels of poultry manure recorded lowest onion yield thereby net income was in the lowest range. The variation in onion yield under the various treatments may be due to variation in their growth and yield attributes responsible for ultimate yield and net income. The present results agree with those of Jawadagi *et al.* (2012), Jamir *et al.* (2013), Latha and Sharanappa (2014) and Verma *et al.* (2014).

It may be concluded that Agrifound Dark Red variety of onion may be grown with 150 kg N + 80 kg P₂O₅ + 80 kg K₂O ha⁻¹ to achieve maximum bulb yield and benefits under the existing agro-climatic conditions of Gwalior region. However 10 t FYM ha⁻¹ alone also produced relatively higher yield as compared to vermicompost and poultry manure.

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