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Impact of Improved *Kharif* Onion Varieties in Andhra Pradesh

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ABSTRACT: Onion is being grown in Andhra Pradesh in an area of 44,600 ha with productivity of 16.2 t/ha whereas the national productivity is 18.64 t/ha. Kurnool district is leading in its area and production in Andhra Pradesh state with average productivity of 16.0 t/ha which is lower than the national average productivity. Farmers in Kurnool district despite availability of improved high yielding varieties due to lack of awareness they are growing traditional non-descript (local) varieties in *Kharif* season as a result of which getting poor yields and low net returns. Challenges are to make farmers aware of latest varieties suitable for *kharif* and ensure their adoption in the field in order to increase the production, productivity and net income to the farmers. To achieve this National Horticultural Research and Development Foundation (NHRDF), Kurnool in collaboration with District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Kurnool conducted demonstrations by practicing Integrated Crop Management practices with L-883 and Agrifound Dark Red improved varieties of NHRDF for three years from 2016 to 2018 in *Kharif* season in 30 ha area at different locations of Kurnool district in selected farmers' fields. The productivity and economic returns of onion in demonstrations fields were calculated and compared with the corresponding farmer's practices. Both the varieties recorded higher gross return, net return and cost benefit ratio in demonstration fields as compared to the control plots. Results showed that over the years L-883 and Agrifound dark red varieties performed superior over local check. In case of L-883 variety the gross returns were Rs. 2,74,414/ha, net returns were Rs. 1,18,781/ha with extension gap of 72.30 q/ha, technology gap of 62.0 q/ha, technology index was 20.6% and B:C ratio was 1.76 compared to local variety. In case of Agrifound Dark Red onion variety the gross returns were Rs. 2,27,316/ha, net returns were Rs.76,716/ha with extension gap of 33.7 q/ha, technology gap of 50.6 q/ha, technology index was 20.2% and B:C ratio was 1.5 compared to local variety. L-883 variety harvested 26 days before and Agrifound dark red 16 days before local variety. Further bulb diameters, bulb weight, plant height at maturity, TSS, dry matter % were found to be high in improved varieties compared to local check. Significance in yield difference was found at $p < 0.01$ in both the improved varieties compared to check variety. Main contributions of this study were farmers made aware of latest improved verities as a result of which there was increase in production, productivity and net income as well as the livelihood of the farming community.

Keywords: Demonstration, Perceived attributes, Technology gap, Extension gap, Technology index, improved Onion varieties.

INTRODUCTION

Onions are one of the most valuable and ancient bulb crops consumed worldwide (Shigyo and Kik 2008; Singh, 2009). India is world leader in area and production of onion. After potato and tomato, onion is considered the third most valuable vegetable in the world grown in 140 countries over an area of 54.8 lakh hectares with an output of 1045.54 lakh tons. The average productivity of the world is 23.06 tons/ha. The area under onion production in the world majorly belongs to India (14.34 lakh ha) and China (10.9 ha) followed by Nigeria (6.6 lakh ha), Indonesia (1.9 lakh ha), Bangladesh (1.9 lakh ha), Pakistan (1.5 lakh ha), Sudan (1.1 lakh ha), Viet Nam (1.0 lakh ha), Egypt (0.9 lakh ha), Uganda (0.8 lakh ha), Myanmar (0.7 lakh ha), Turkey (0.7 lakh ha), Russian Federation (0.6 lakh ha), Ukraine (0.6 lakh ha) (Kale *et al.*, 2022). There is a lot of demand for Indian Onions in the world; India has exported 21.8 lakh tonnes of fresh Onions worth of Rs. 3468.83 crores during 2018-19, among which (26.5%) of total onion exported to Bangladesh followed by Malaysia (15.2%), UAE (11.8%) Sri Lanka (10.3%)

(Mahmadajaruddin and Mamani 2018). The main onion growing states of India are Maharashtra (31.19%), Madhya Pradesh (13.61%), Karnataka, (12.88%), Rajasthan (6.86%), Gujarat (6.48%), Bihar (5.96%), Andhra Pradesh (4.23%), Haryana (3.37%) and others (15.52%) (Area and Production of Horticulture Crops: All India, National Horticulture Board, Ministry of Agriculture & Farmers' Welfare, Govt. of India). Onion is being grown in Andhra Pradesh in an area of 44,600 ha with productivity of 16.2 t/ha whereas in India it is 18.64 t/ha. Kurnool district of Andhra Pradesh is leading in its area and production in Andhra Pradesh state with average productivity of 16.0 t/ha (AP Socio economic survey, 2021-22). The production and productivity of onion in Andhra Pradesh are low compared to Gujarat, Maharashtra and other onion growing states (Gupta and Singh 2010). In Kurnool district of Andhra Pradesh during *Kharif* season majority of the farmers (90%) grow local variety coupled with non-adoption of Integrated Crop Management (ICM) practices getting low yields and net returns (Ojha and Singh 2013; Pandey and Bhondey 2002). Hence, there is a need to maximize the onion cultivation area with the introduction of improved cultivation technologies with high yielding varieties for onion crop. In the survey made to compile production level of onion crop at grass root level, it comes to know that, among all the production factors variety contribute a major share in the crop production. The productivity of onion is much low in India than the world average (Lawanda, 2005). In this study two improved varieties *viz* L-883 and Agrifound Dark Red, developed by National Horticultural Research and Development Foundation (NHRDF) were demonstrated for higher yields and net returns to farmers in Kurnool district of Andhra Pradesh for three years 2016 to 2018 and its impact in terms of yields, gross returns, net returns, BC ratio and significance of yields were studied during *Kharif* season as majority of the farmers (90%) grow traditional variety during this season.

Demonstrations on these two improved high yielding varieties (Table 1) *i.e.* L-883 and Agrifound Dark Red were conducted in 30 ha area in different location of Kurnool district from 2016 to 2018 along with local check variety for comparison and timely biometric observations on crop performance were recorded and analyzed for drawing inferences.

Table 1: Particulars of demonstrations conducted during *Kharif* 2016 to 2018.

Sr. No.	Year	Area (ha)		
		Trial-1 (L-883)	Trial-2 (ADR)	control
1.	2016	10	10	10
2.	2017	10	10	10
3.	2018	10	10	10
Total		**30**	**30**	**30**

ADR- Agrifound Dark Red

Table 2: Characters of improved varieties.

Variety	Bulbs colour	Shape of Bulbs	Maturity After transplanting (days)	Bulb Diameter (cm)	Weight of bulb (g)	Plant Height (cm) At Maturity stage	TSS %	Dry matter %	Yield (q/ha)
L-883	Darkred	Globular shape with tight skin	90	5.25	78.02	75.4	12-13	13-14	300
Agrifound Dark Red	Darkred	Globular shape with tight skin	100	5.10	71.08	72.4	12-13	13-14	250
Local	Mix & dark red	Mix shape & Size	116	4.82	56.25	70.1	11-12	11-12	150

In this study totally 2 high yielding varieties (Table 2) along with local variety as a control plot were evaluated to assess their performance for high productivity in Kurnool district of Andhra Pradesh. Therefore, crop demonstrations on integrated crop management in onion varieties L-883 and Agrifound Dark Red were conducted in farmers' fields during *Kharif* season from 2016 to 2018 for three years jointly by National Horticultural Research and Development Foundation (NHRDF), Kurnool under MIDH (Mission for Integrated Development of Horticulture) with District Agricultural Advisory and Transfer of Technology Centre (DAATTC), Kurnool in different locations of Kurnool district. Tiwari *et al* (2022) was also conducted which are related to costs and returns of onion crop.

MATERIALS AND METHODS

The present study was carried out during *Kharif* season on the 120 farmers' fields of different locations in Kurnool district. A large scale 40 demonstrations each in 10 ha area on onion varieties L-883 and Agrifound Dark Red (ADR) were conducted by NHRDF-Kurnool in collaboration with District Agriculture Advisory and Transfer of Technology Centre (DAATTC), Kurnool from 2016 to 2018. Every year 5 major onion growing mandals *viz.* Gonegandla, Yemmiganur, Kurnool, Kodumur and Dhone were purposively selected for the study. From each mandal two villages were selected randomly and from each village 4 farmers were selected for demonstrations constituting totally 40 farmers in

every year in 10 ha area (0.25 ha area for each demonstration). In case of local control plots; existing practices being used by farmers were followed. In general soils of the area under study were clay loams with low to medium fertility status. The demonstrations were conducted to study the gaps between the potential yield and demonstration yield, extension gap and technology index. In the present study, the data on output of *Kharif* onion cultivation were collected from demonstration plots, besides the data on local practices commonly adopted by the farmers of this region were also collected through well-developed questionnaire and interview method. The data on production cost, inputs used, monetary return, gap and technology index were collected and analyzed for the economic feasibility of the recommended technology were calculated by using following formula.

Operationalization of various parameters:

- Technology gap = Potential yield - Demonstration yield
- Extension gap = Demonstration yield - Yield under existing practice
- Technology index = Potential yield - Demonstration yield × 100 /Potential yield
- Impact of yield = Yield of demonstration plot-Yield of control plot/Yield of control plot × 100

Adoption was operationally defined as the degree of actual use of recommended cultivation practices by onion growers. In demonstration plots, a few critical inputs in the farm of quality seed, sticky traps, bio-fungicides like *Trichoderma viride, pseudomonas fluorescens*, bio-fertilizers, need based plant protection measures etc. were provided and non-monetary inputs like seed treatment, timely sowing in ridge and furrow method, technical advisories, IPM practices adopted in all demonstration plots. Farmers' practices were maintained in case of local control. The farmers involved in demonstration were facilitated technical information by NHRDF experts and DAATT Centre scientist in performing field operations like nursery sowing, nursery treatment, transplanting, irrigation, timely spraying of plant protection chemicals, weeding, harvesting etc. through regular capacity building trainings and field visits.

RESULTS AND DISCUSSION

The data were pooled on different parameters and the results obtained were discussed accordingly. The empirical results were discussed under the sub-sections including perceived attributes of innovation, performance of demonstrations in terms of yields, percent increase in yield, extension gap, technology gap and technology index, cost economics of demonstrations, significant yield difference among demonstrated and local check varieties and technology spread.

Table 3: Perceived attributes of latest varieties by farmers: (n=120).

Sr. No.	Perceive attributes	L-883		Agrifound Dark Red	
		Frequency	%	Frequency	%
1.	Relative advantage	113	94.17	112	93.33
2.	Complexity	8	6.67	12	10.00
3.	Compatibility	117	97.50	112	93.33
4.	Trialability	118	98.33	113	94.17
5.	Observability	114	95.00	112	93.33

Feedback on the performance of new varieties was obtained from 120 farmers by using well-structured interview schedule and the results were shown in Table 3. A critical analysis of perceived attributes of latest varieties by farmers revealed that 94.17 & 93.3 percent of the farmers expressed that L-883 and Agrifound Dark Red improved varieties have got more relative advantage over local check variety. Similarly 97.5 & 93.3 percent farmers expressed compatibility, 98.3 & 94.17 percent farmers expressed trialability and 95.0 & 93.3 percent farmers expressed observability of additional benefits in L-883 and Agrifound Dark Red improved varieties respectively compared to local check variety. Merely 6.6 & 10.0 percent farmers expressed that there was complexity in adoption of these two improved varieties respectively compared to local check probably because of more cost of seed.

Table 4: Potential yield, technology gap, extension gap and technology index of onion crop in different varieties under TDTD in Kurnool district of AP state during Kharif – 2016 to 2018.

Variety	Yields 2016 (q/ha.)		Yields 2017 (q/ha)		Yields 2018 (q/ha)		Avg. Yield (q/ha)		Potential yield (q/ha)	% increase in yield over control	Extension gap (q/ha)	Technology gap (q/ha)	Technology index (%)
	D	C	D	C	D	C	D	C					
L-883	230.0	158.5	248.0	171.5	236.0	167.2	238.0	165.7	300	43.6	72.3	62	20.6
ADR	194.25	158.5	204.6	171.5	199.2	167.2	199.4	165.7	250	20.3	33.7	50.6	20.2

ADR-Agrifound Dark Red; D- Demonstration; C-Control

From the data presented in Table 4, it is revealed that demonstration yield of L-883 and Agrifound Dark Red performed better than their respective local check. L-883 variety recorded highest yield of 238 q/ha with 43.6% average increased yield over the control plot followed by Agrifound Dark Red which gave 199.4 q/ha with 20.3% average increase yield over control plot. Yield improvement due to use of improved varieties in *Kharif* was also reported by Tripathy *et al.* (2014); Mohanty and Prusti (2001); Yadav *et al.* (2022); Gosai *et al*. (2018).

Further extension gap of 72.3 q/ha was recorded inL-883 variety and in Agrifound Dark Red it was 33.7q/ha that is the gap between demonstration technology and control plot. The progressive use of improved crop production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. This emphasized the need to educate the farmers through various extension means for adoption of improved varieties to reduce wider extension gap. Reduced extension gap and technology gaps due to use of latest varieties were also reported by Tiwari *et al.*(2022); Dewangan *et al*. (2012); Dikshit *et al.* (2020).

The technology gap of 62 q/ha was recorded in L-883 variety and in case of Agrifound Dark it was 50.6 q/ha *i.e.* yield gap between demonstrated technology and potential yield that could still to be minimized with favorable climactic and soil factors. Similar results were also expressed by Tiwari *et al.* (2022).

The technology index shows the feasibility of the variety in farmer's field. The lower the value of technology index more is the feasibility. Data is Table 4 revealed that the technology index was 20.6% in L-883 variety where as it was 20.2% in Agrifound Dark Red variety suggesting the superiority and better performance of both the varieties compared to local. It shows more feasibility of technology disseminations in the state. Better performance of NHRDF variety was also reported by Vibhute and Singh (2019) in their research study conducted in Madhya Pradesh. Due to adoption of ICM practices improvement in yield was also reported by Ranjith and Sharma (2021) in their study conducted in Maharashtra.

The variety wise economics of onion production under demonstrations were estimated and the results have been presented in Table 5. The economics analysis of the data over the year revealed that L-883 variety recorded higher gross returns Rs. 2,74,414/- and net returns Rs. 1,18,781/-with B:C ratio 1.76 per hectare compared to local variety. That is the additional net returns Rs. 1,06,295/- on the additional expense of Rs. 12,486/-only as an adoption cost over control per hectare. In case of Agrifound Dark Red variety gross returns were Rs. 2,27,316/- per hectare, net returns were Rs. 76,716/- and B:C ratio 1.5 compared to local check variety. Additional net returns of Rs.66,079/- was obtained on additional expense of Rs.10,637/- per hectare as an adoption cost over control. The higher returns were due to higher bulbs yields as well as higher market price with sorting/grading of bulbs obtained in the demonstration technology over control plots. It was also revealed that returns were directly influenced by the market price of onion bulbs and cost of production during the year of the demonstrations. These findings are in confirmation with the findings of Ojha and Singh (2013); Dwivedi *et al.* (2013).

Table 5: Comparison of returns onion cultivation for both the varieties during 2016 to 2018:

Parameters	L-883	Agrifound dark Red	Local
Cost of production(Rs/ha)	1,55,633	1,50,600	1,40,030
Adoption cost of production over control (Rs/ha)	12,486	10,637	-
Sale @Rs/Q(Rs)	1153	1140	940
Gross return(Rs/ha)	2,74,414	2,27,316	1,87,436
Net return(Rs/ha)	1,18,781	76,716	47,406
Additional net returns over control(Rs/ha)	1,06,295	66,079	-
B:C ratio	1.76	1.5	1.3

Table 6: Significance of yields in improved varieties compared with local.

Sr. No.	Season/Year	No. of demos	Average Yield (q/ha)			Mean difference compared with local(q/ha)		't'-cal. Value	
			L-883	Agrifound Dark Red	Local	L-883	Agrifound dark red	L-883	Agrifound dark red
1.	*Kharif*, 2016	n=20	230.0	194.2	167.7	62.3	26.5	7.1**	4.41**
2.	*Kharif*, 2017	n=20	248.0	204.6	171.0	77.0	33.6	11.3**	5.8**
3.	*Kharif*, 2018	n=20	236.0	199.2	158.5	77.5	40.7	14.95**	10.78**

**significant at 0.01 level of probability

By using the statistical tools like 't' test, significant difference on yields was tested between improved variety and lock check. Results shown in Table 6 revealed that L-883 and Agrifound Dark Red varieties yields were found to be significant at 0.01 level of probability compared to local check in all three years. Significant yield improvement in yields of improved onion varieties was also reported by Tiwari *et al.* (2022); Ojha and Singh (2013) in their study conducted in Bihar and Andhra Pradesh states respectively. Significant difference in yields among improved varieties was also reported by Behera *et al.* (2017); Shah *et al.* (2012); Srivastav *et al.* (2017).

CONCLUSIONS

Performance of both NHRDF varieties *viz.*, L-883 and Agrifound Dark Red under demonstration were found to be better than their respective local check. The NHRDF L-883 variety recorded highest yield of 236q/ha with 43.6% average increased yield over the control plot followed by Agrifound Dark Red (199.4 Q/ha) with 20.02%. The economics analysis of the data over three years revealed that L-883 onion variety recorded higher gross returns Rs. 2,74,414/-, net returns Rs.1,18,781/- per hectare and B:C ratio 1.76 compared to local check variety. In case of Agrifound Dark Red variety gross returns were Rs. 2,27,316/- per hectare, net returns were Rs.76,716/- and B:C ratio 1.5 compared to local check variety. That is the additional net returns Rs. 1,06,295/-in L-883 variety on the additional expense of Rs. 12,486/- and in Agrifound Dark Red variety it was Rs. 66,079/- on additional expense of Rs.10,637/- per hectare as an adoption cost over control. Hence it could be concluded that due to adoption of improved varieties and ICM practices instead of using local varieties and traditional practices farmers can get an additional net returns per hectare with improvement in production by 20-42%.

FUTURE SCOPE

In this study we have included only two improved varieties of NHRDF. There is a further scope to include other better performing onion varieties released by ICAR institutes like IIHR, Bangalore and DOGR, Pune for providing wide basket of varieties to the farmers for his choice based on agro ecological farming situation and to get higher yields and net returns.

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Conflict of Interest. None.

REFERENCES

AP Socio Economic Survey (2021-22). http://apsdps.ap.gov.in/WeatherPages/Reports-Publications/Socio-eco/Socio_Economic_Survey_2021-22.pdf, Page.no.350

Area and Production of Horticulture Crops : All India, National Horticulture Board, Ministry of Agriculture &Farmers Welfare, Govt. of India, https://agricoop.nic.in/sites/default/files/2020-21%20(Final)%20Advance%20Estimates%202020-21%20(1).pdf

Behera, T. K., Mandal, J., Mohanta, S., Padhiary, A.K., Behera, S., Behera, D. and Rout, R. K. (2017). Assessment of growth, yield and quality of onion genotypes under red and laterite zone of West Bengal. *Journal of Pharmacognosy and Phytochemistry*, *6*(6), 493-497.

Dewangan, S. R., Sahu, G. D. and Kumar, A. (2012). Evaluation of different *Kharif* Onion (*Allium cepa* L.) genotypes in Chhattisgarh plains. *Indian Horticulture Journal*, *2*(1&2), 43-45.

Dikshit, A., Pandey, N. K., Tiwari, D. and Chauhan, A. K. (2020). Evaluation of Onion (*Allium cepa* L.) varieties for its suitability in Bundelkhand region. *J. Krishi Vigayan*, *9*(1), 73-76.

Dwivedi, Y. C., Kushwah, S. S. and Sengupta, S. K. (2013). Evaluation of onion varieties for growth, yield and quality traits under agro-climatic conditions of kymore plateau region of Madhya Pradesh, India. *Agricultural Science Digest*, *32*(4), 326-328.

Gosai, J. A., Rathawa, S. N., Dhakad, R. K., Jatav, A. and Verma, L. R. (2018). Evaluation of different varieties of Onion (*Allium cepa* L.) Under North Gujarat condition. *International Journal of Current Microbiology and Applied Science*, *7*(5), 3775-3780.

Gupta, R. P. and Singh, R. K. (2010). Area and production, Onion production in India-2010, pp 6-9.

Kale, R. B., Gadge, S. S., Rao, B. V., Mahajan, V. and Singh, M. (2022). Good Agricultural Practices in Onion and Garlic Production. Directorate of Onion and Garlic Research, Rajgurunagar, Pune, India. pp.01.

Lawanda, K. E. (2005). Onion improvement present status and future trust National symposium on current trends in onion, garlic and seed spices- production, marketing and utilization, held at NRCOG, Rajagurunagar, Pune during 25-27 November, pp-1-11.

Mahmadajaruddin, G. and Mamani, A. (2020). Growth and export performance of Onion in India: An economic analysis. *Journal of Pharmacognosy and Phytochemistry*, Sp9(4), 346-349.

Mohanty, B. K. and Prusti, A. M. (2001). Performance of common onion varieties in *kharif* seasons. *Journal of Tropical Agriculture*, *39*, 21-23.

Ojha, M. D. and Singh, H. (2013). Evaluation of Technology Dissemination through Demonstration on the Yield of *Kharif* Onion. *Indian Research Journal of Extension Education*, *13*(1), 129-131.

Pandey, U. B. and Bhonde, S. R.(2002). Agro-Techniques. Onion production in India-2002, pp 12-15.

Rajput, S., Rajput, A. S., Jain, V. and Verma, S. K. (2018). Analysis of Yield Gap in Onion under Front Line Demonstration at Janjgir-Champa District of Chhattisgarh, India. *International Journal of Current Microbiology and Applied Sciences*, Special Issue-*7*, 4104-4108.

Ranjith, P. C. and Sharma, S. (2021). Yield and Economic Performance of Onion Cultivation in Maharashtra. Agricultural Situation in India, LXXVIII(4), 25-36.

Shah, S. T., Sajid, M., Alam, R., Rab, A., Mateen, A. and Jan, I. (2012). Comparative study of onion cultivars at Mardan, Khyber Pakhtunkhwa - Pakistan. *Sarhad Journal of Agriculture*, *28*(3), 399-402.

Shigyo, M. and Kik, C. (2008). Onion. In: Vegetables II (pp. 121–159). Springer.

Singh, U. (2009). A History of ancient and early medieval India: From the Stone Age to the 12th century (PB). Pearson Education India.

Srivastav, G., Vikram, B. and Prasad, V. M. (2017). Studies on multiple correlation between bulb yield, growth and yield attributes in different genotypes of onion (*Allium cepa* L.) under Allahabad agro-climactic condition. *Journal of Pharmacognosy and Phytochemistry*, *6*(6), 793-798.

Tiwari, J. K., Divya, Kumar, A. and Singh, S. (2022). Evaluation of different Rabi Onion Varieties under Bihar Conditions. *Journal of Agri Search*, *9*(3), 222-225.

Tripathy, P., Sahoo, B. B., Priyadarshini, A., Das, S. K. and Dash, D. K. (2014). Standardization of Kharif Onion Cultivars, *International Journal of Bio-resource and Stress Management*, *5*(2), 269-274.

Vibhute, M. and Singh, A. (2019). Evaluation of different varieties of onion in Nimarregion of Madhya Pradesh. *Agriculture Update,14*(1), 33-36.

Yadav, S, Deen, B. and Yadav, K. S. (2022). Studies on the Performance of Onion (*Allium cepa* L.) varieties Inter cropping in Pre-bearing Kinnow (*Citrus reticulata* Blanco) Orchard. *Biological Forum – An International Journal, 14*(4), 1166-1170.

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