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Effect of sulphur on onion bulb production under frontline demonstrations in Buldhana District of Maharashtra

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Abstract
Onion (*Allium cepa* L.) is an important bulb vegetable crop with Onion has high demand for the sulphur which affects the Bulb Quality and Productivity but it should be applied in the field carefully so, as it produces acidic effects and adversely affects the plant. Front line demonstration is one of the key extension tools for transfer of technology at grass root level that directly impact the horizontal spread of technology. In order to increase the production of Rabi onion var. AFLR with the by use of sulphur @ 30kg/ha were carried out by Krishi Vigyan Kendra, Buldhana in adopted Farmers fields at different villages during the years 2018-19 to 2022-23. In all 65 demonstrations were conducted on 26 ha area on 65 farmers field during the five years. The demonstrated recorded an average yield ranging from 27090-31040 kg/ha with a mean of 29140 kg/ha. The per cent increase yield was obtained with the application of Sulphur @30 kg/ha 5.33% during 2018-19, 14.03% during 2019-20, 9.85% during 2020-21, 14.03% during 2021-22 and 9.85% during 2022-23 respectively, over the local check. The average technology gap (2860 Kg/ha), extension gap (2798) and technology index were 8.94% during the period under study. The application of Sulphur at this rate had been found to be non-tedious, economically feasible and more convenient. The demonstrated field gave average benefit: cost ratio (3.17) compared to the local checks. Present results clearly show that the yield and economics of onion can be boost up by adoption sulphur @ 30kg/ha in onion var. AFLR.

Keywords: Onion, FLD, sulphur, yield, extension gap, technology gap

Introduction
Onion (*Allium cepa* L.) belongs to family Aliceae whose origin is considered to be Central Asia. It is widely grown for the vegetables and spices. Onion pertain high socio-economic importance in India. Onion contains 1285 thousand hector area with 23262 MT productions whereas rest of the production is used for self-utilization. The economics of the onion bulb and these attributes depends upon Nitrogen, Phosphorous, Potassium and Sulphur (Kurtz and Ernani, 2010) [5].

Onion had been reported to required high amount of Sulphur than other nutrients. Less amount of Sulphur whenever be advocated from the optimum doze, it may limits yield and its attributes at any stage of crop production. From few previous decades, the application of Sulphur combination to other fertilizers had taken an admirable position in the production as far as trade, quality and fertilizer use efficiency is concerned. Sulphur is secondary macro-nutrient which have positive effects on the family as well as various variety of onion and whose application leads to several effect on the soil as well as plant's physiology viz reducing soil and plants pH, improving soil water plant relationship, availability of various nutrients such as Phosphorous, Iron, Manganese and Zinc (Bloem et al., 2004) [1].

Onion is relatively poor source of certain nutrients (i.e., fats, carbohydrates and proteins but is generally valued for its well-known characteristic flavour. The known compounds of raw and cooked onions (and other allium species) are rich in sulphur compounds of which mono-, di- and tri-sulphate compound. Trade market of onion exclusively depends upon the flavour and low pungency onion cultivar. These factors had been studied to be dependent on the Sulphur accumulation. Thus, the use of elemental Sulphur in the fertilizer mixture shall be an alternative for increasing the nutrient control and meeting plant requirement (Gallina et al., 2012) [2].

The variation in cultivar differs in their efficiency in absorbing the Sulphur content. Thus, a study is conducted on the Effect of Sulphur on the yield, technology gap, extension gap and technology index and its attributes using agri-found light red (AFLR) at farmers field of, Buldhana District, Maharashtra.

Material and Methods

The frontline demonstrations were conducted by KrishiVigyan Kendra, Buldhana in Buldhana district during years 2018-19 to 2022-23. In all 65 demonstrations were conducted on 26 ha area on 65 farmers field during the five years. The yield and economic performance of frontline demonstrations on use of sulphur @ 30kg/ha in onion var. AFLR, the data on output were collected from FLDs as well as local plots and finally the grain yield, cost of cultivation, net returns with the benefit cost ratio was worked out. For the purpose of investigation, Buldhana district, where FLDs were conducted during 2018-19 to 2022-23. For selection of beneficiary farmers, a list of farmers where FLDs on use of sulphur @ 30kg/ha in onion var. AFLR were conducted during Rabi 2018-19 to 2022-23 was prepared and taking equal representation. The soils of the cultivation areas where demonstration were conducted are medium to heavy, contains low organic matter, medium nitrogen and phosphorous and high potassium in the soil.

The sulphur @ 30kg/ha distributed to farmers for conduction of demonstrations. Prior to conduct the FLD/s at Farmers field trainings on nursery raising for onion crop and Integrated crop management technology for onion were conducted for the beneficiaries by SMS (Horticulture) at farmer's villages. During the training session, farmers were guided on the aspects of land preparation, preparation of nursery beds, seed treatment, seed sowing and transplanting, nutrient management and weed management practices, plant protection, harvesting, curing of bulbs and post-harvest practices.

The technology use of sulphur @ 30kg/ha in onion var. AFLR that demonstrated against the farmers practice no use of sulphur for conduction of front line demonstrations were described in the tabulated form in the Table 1(5). Right from nursery sowing till harvesting of the crop, the demonstrated plots were frequently visited and supervised by the scientist for correct implementation of the technology at proper time by the farmers. A field day was conducted before a month of crop harvesting by KVK scientists at demonstration farmer's fields.

The data were collected through personal contacts with the help of well-structured interview schedule. The gathered data were processed, tabulated, classified and analyzed in terms of mean percent score and ranks in the light of objectives of the study. More than 10 percent difference between beneficiary and non-beneficiary farmers' was considered as significant difference. The extension gap, technology gap and technology index were calculated using the formula as suggested by Samui et al., (2000) [8].

Extension gap (qha^{-1}) = Demonstration yield-Farmer's yield

Technology gap (qha^{-1}) = Potential yield -Demonstration yield

Technology index (%) = [Potential yield-Demo yield/Potential yield] x 100

Table 1: Technology details for the study on integrated crop management technology for onion crop under front line demonstration

S.N.	Particulars	Technology for Onion cultivation under	
		Demonstration	Local check /Farmer's practice
1.	Farming situation	Irrigated	Irrigated
2.	Variety	AFLR	AFLR
3.	Time of Nursery raising and seed sowing	Nov 1st week. Seeds were sown in rows spaced 10 cm apart	November-Dec. Seeds sown by line sowing method
4.	Seed rate	10 kg/ha.	10 kg/ha.
5.	Technology	Soil application of Sulphur@30 kg as basal dose	No use of Sulphur
6.	Transplanting	January 2nd fortnight	January 2nd fortnight
7.	Weed management	Pre emergence weedicide application of oxyflurofen 23.5% EC 0.1-0.15 kg a.i./ha + 1 HW at 45 DAT	Pre emergence weedicide application of oxyflurofen 23.5% EC 0.1-0.15 kg a.i./ha + 1 HW at 45 DAT
8.	Fertilizer dose	Soil application of Sulphur@30 kg as basal dose and 100:50:50 kg NPK/ha. Half N & full P2O5 and K2O applied at the time of transplanting and half dose of N 1 month after TP.	100:50:50 kg NPK/ha. Half N & full P2O5 and K2O applied at the time of transplanting and half dose of N 1 month after TP.
9.	Plant protection measures	Application of fungicide Dithane M-45 for control of blight disease.	Application of fungicide Dithane M-45 for control of blight disease.

Results and Discussion

The data regarding bulb yield of onion crop, yield, technology gap, extension gap and technology index for onion crop for the demonstration during Rabi 2018-19 to 2022-23 were recorded and reported in table 2 and discussed under following parameters.

Crop yield

The data regarding bulb yield of onion crop presented in table 2, it was revealed that, the increased onion bulb yield over the check were noticed during 2018-19 to 2022-23 the years of demonstration. The maximum average onion bulbs yield 29140 kg/ha was obtained in the demonstrated technology (Soil application of Sulphur@30 kg as basal dose) with 10.61% average increased yield over the local check (no use of sulphur). The results are in accordance with the results obtained by Tripathy *et al.* 2013 [10] and Meher *et al.*, (2015) [6] for onion crops. A similar yield enhancement in different crops through front line demonstration was reported by Balai *et al*. 2013 in vegetables.

The increased crop yield in demonstrated plots showed the feasibility of demonstrated technology and suitability of onion var. Akola safe under Buldhana climatic condition. The increased in yield may be due to high yielding demonstrated onion variety AFLR with nutrient management technology contributed for increased crop yield over check, Warade *et al.*, 2008 [11].

Table 2: Yield, productivity, technology gap, extension gap and technology index of onion crop under FLDs

Year	No of FLDs	Area covered (ha)	Yield (Kg/ha)		Additional yield over local check (kg/ha)	Per cent increase yield over Local Check
			FLD	Local check		
2018-19	13	5.2	29440	27950	1490	5.33%
2019-20	13	5.2	31040	27220	3820	14.03%
2020-21	13	5.2	27090	24660	2430	9.85%
2021-22	13	5.2	31040	27220	3820	14.03%
2022-23	13	5.2	27090	24660	2430	9.85%
Mean	13	5.2	29140	26342	2798	10.61%

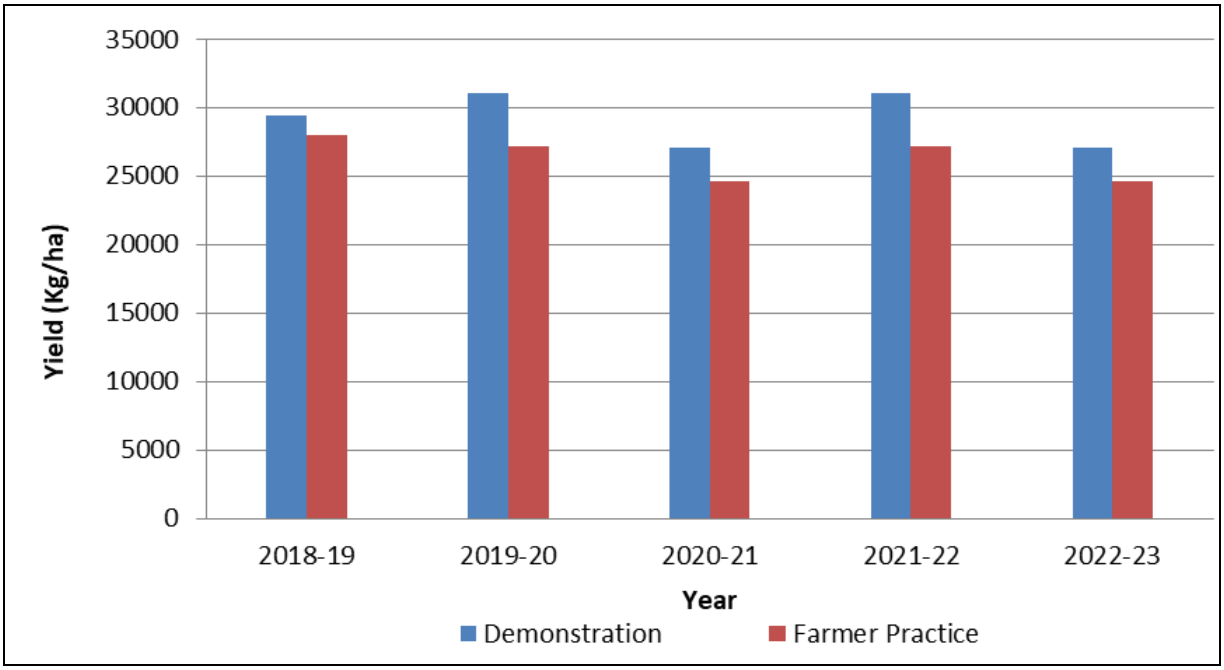

Table 3: Yield gap and technology index in front line demonstrations

Year	No of FLDs	Technology gap (Kg/ha)	Extension Gap (Kg/ha)	Technology Index (%)
2018-19	13	2560	1490	8.00
2019-20	13	960	3820	3.00
2020-21	13	4910	2430	15.34
2021-22	13	960	3820	3.00
2022-23	13	4910	2430	15.34
Mean	13	2860	2798	8.94

Technology Gap

From the data presented in table 3, the average technology gap of 2860 kg/ha. Was reported i.e. the yield gap between demonstrated technology and potential yield that needs to be minimized with the conduction of FLDs.

The variation in technology gap during the demonstration years may be due to varied soil fertility, climatic condition of the area and management practices implemented by the farmers. Hence, more location specific recommendations and precise use of technology in the fields are necessary to bridge the technology gap as supported by Singh *et al.* 2011 [9].

Extension Gap

The average extension gap (2798 kg/ha.) between demonstrated technology and local check was mostly due to the use of lacking in adoption of high yielding variety and use of improved production technology. The results are in conformity with the findings of Singh *et al.* 2011 [9]. Who stated the progressive use of improved crop production technologies with high yielding variety will subsequently change this alarming trend of galloping extension gap. It directed to educate and emphasized the farmers for the adoption of demonstrated technologies so as to bridge the extension gap by planning and implementation of technologies through various means of extension. The results are in agreement with the research worker Mukharjee, 2003 [7], who stated that, location based problem identification and thereby specific interventions may have great implications in the enhancement of crop productivity.

Technology Index

The technology index reported in table 3, showed the average technology index value 8.94% might be due to précised use of demonstrated technologies in the field and suitable climatic conditions during demonstration period. As technology index denotes the gap between technology generated at research farm and farmer's field, lower the technology index more feasible will be the technology Hiremath and Nagraju, 2010 [4].

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