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Effect of sets/seedlings and weed management practices on bulb yield in Kharif onion

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Abstract

Onion occupies an important place in daily diet and is semi-perishable in nature. The production of off-season onion in Kharif season in North Indian plains can stabilize the market supply of fresh onion as well as its price in winter and spring seasons. Keeping this in view, the present investigation was carried out at the experimental farm of Krishi Vigyan Kendra, Bilaspur, Himachal Pradesh during 2013 and 2014. Two varieties namely, N-53 and Agrifound Dark Red (AFDR) were evaluated using sets and seedlings following randomized block design in four replications along with Farmer practice (FP). The marketable bulb yield of both the varieties raised through sets was significantly higher than those raised from seedlings during both the years. The higher bulb yield was the result of low mortality of seedlings and improved crop stand which resulted in higher economic returns. In another experiment on weed management practices, pre- emergence application of alachlor and pendimethalin @ 1.00 kg a.i. /ha, respectively along with hand weeding at 40 days after planting resulted in significantly higher bulb yield compared to their sole application. Hence, Kharif onion crop raised through sets of AFDR variety followed by N-53 is better than seedling raised crop under low hill conditions of Himachal Pradesh.

Key words: Onion, seedlings, weed management, bulb yield.

Onion (*Allium cepa* L.), commonly known as pyaz, is one of the most important bulb crops, having year round demand in almost every household. Traditionally, onion is cultivated during winter months, i.e., sowing in November-December and harvesting in April-May under North Indian plains as rabi onion. The April-May harvested crop of this region has to meet the market demand till the harvesting of next year crop, which results in sky rocketing prices from October to March, because till October, rabi crop can be stored with about 40 per cent storage loss due to sprouting and rotting (Joshi *et al.* 2012). Therefore, *Kharif* onion had played a major role in enhancing the production, supply and reducing the price rise as most of the onions marketed this time in North Indian plains are brought from Maharashtra and southern parts of the country. Varieties have been developed to produce *Kharif* onion during rainy season in North Indian condition, with a few supplemental irrigation which caters the domestic demand and also fetches good market price. However, production of *Kharif* onion across India is limited due to non-availability of location-specific varieties and suitable production methodology. Planting material is the key factor for successful production of off-season onion in *Kharif* season. The *Kharif* onion is normally produced through seedling, raised during July and transplanted in August. Because of erratic rainfall, high temperature, high humidity, tenderness of seedlings and crop-weed-competition, seedling mortality occurs in the field (Som *et al.* 2003). Patel *et al.* (2009) reported that crop raised through sets have good bulb yield potential from the shortest span of 62 to 73 days which otherwise, normally required for seedlings in the nursery. Therefore, an attempt has been made to assess the potential of *Kharif* onion production through sets for successful cultivation under low hill conditions of Himachal Pradesh.

Materials and Methods

The present investigation was carried out at the experimental farm as well as in the farmer's field of the operational area of Krishi Vigyan Kendra, Bilaspur, Himachal Pradesh for two consecutive years, i.e., March to December of 2013 and 2014. In the first experiment, two varieties namely, N-53 and Agrifound Dark Red (AFDR) using sets and seedlings, respectively were planted by following randomized block design in four replications and these treatments were compared with Farmer practice (FP). Both seedlings and sets were planted at a spacing of 15 cm × 10 cm in a well prepared field in the second fortnight of August in the respective years. Besides, experiment comprised of different weed management practices was also conducted during both the years. In this context, eight treatment combinations comprised of pre- emergence application of pendimethalin and alachlor at two concentrations of 1.00 and 1.50 kg a.i./ha alone,

Pendimethalin @ 1 kg ai/ha + one hand weeding (HW) at 40 days after planting (DAP), Alachlor @ 1 kg ai/ha + one hand weeding (HW) at 40 DAP, two hand weedings at 20 and 40 DAP and un-weeded treatment were evaluated in randomized block design, replicated thrice.

Production of sets

Seed of Kharif onion varieties N-53 and Agrifound Dark Red (AFDR) was sown on well prepared nursery beds during second fortnight of March. Upto end of April, normal seedlings were raised by providing irrigation as per nursery need. Thereafter, irrigation was withheld during May and as a result, leaves started drying towards the end of May and became brown. Whole plants along with small onion bulbs, known as sets, were uprooted during the first week of June, i.e., before pre monsoon showers (Singh *et al.*, 2015). Harvested sets were kept for curing in a well ventilated room in thin layers. During curing, dry leaves were separated from sets and sets were planted in the second fortnight of August, i.e., after rainy season (Anonymous, 2011). In the farmer's practice, small rabi season onion bulbs used as sets, irrespective of variety, were kept by farmers for planting as sets in the second fortnight of August.

Production of seedlings

For production of onion seedlings during Kharif season, the seeds were sown during first fortnight of July in raised nursery beds. Regular weeding was practiced to prevent weed growth. The seedlings became ready for transplanting in second fortnight of August when they attained a height of 12-13 cm.

Recording of data

The observations were recorded on equatorial and polar diameter, neck thickness, sets/seedlings weight, yield from one kg onion seed sown and their number per kg of set or seedling. The observations were also recorded on plant stand, plant height, bulb diameter, marketable yield, gross return, net return and B:C ratio of crop raised through sets and seedlings of both the varieties. The observations on sprouting percentage were also recorded one month after bulb harvesting. The data were analyzed by following analysis of variance (Gomez and Gomez 1984).

Results and Discussion

Various quantitative parameters of *Kharif* onion varieties raised through sets and seedlings were analysed. A perusal of table 1 revealed that equatorial diameter of seedlings as well as sets of N-53 and AFDR were at par with each other. On the other hand, it was highest (2.4 cm) in farmer's practice where in comparatively large bulbs of rabi onion were used as planting material irrespective of variety. The bulb circumference was higher in farmer practice followed by sets and seedlings of N-53 and AFDR. Weight of 100 bulbs along with leaves was higher in seedlings as compared to sets of both the varieties which were significantly lower than farmer practice. It is due to the fact that the green foliage of seedlings also added to the weight of planting material. It is non-spreading crop and bulbs of small size are preferred as planting material for *Kharif* onion production. The weight of sets produced from one kg onion seed were significantly higher in farmer practice (138.5 kg) compared to both the varieties. This was reflected in producing significantly more number of sets in AFDR followed by N-53 through sets while farmer practice resulted in 5-6 times less planting material than the sets produced from AFDR and N-53. Besides, it was also observed that number of sets per kg weight basis were higher in both the varieties as compared to their seedlings.

The performance and economics of *Kharif* onion crop raised through sets and seedlings (Table 2) revealed that the plant stand was significantly very high in onion crop raised through sets (98-99 %) in both the varieties as compared to seedlings and farmers practice. This indicated that the establishment of sets in field was better than seedlings. Joshi *et al.* (2012) indicated that onion crop raised through sets showed less mortality which may be attributed to the fact that the stored food in onion sets help newly emerging plants to survive better in adverse weather and remain healthier in growth. However, plant height was significantly higher in farmers practice compared to sets or seedlings which might be due to large size of planting material. Agrifound Dark Red through sets resulted in significantly more bulb diameter and average bulb weight followed by N-53 through sets compared to seedlings as well as farmers practice. It is due to the fact that small bulbs kept by farmers of earlier season of any variety and their planting as *Kharif* onion crop lead to more foliage growth and lesser bulb size. Leaves are the major food producing organs which help in better food accumulation in

Table.1 Quantitative characters of sets and seedlings of *Kharif* onion varieties.

Variety (Seedling/Set)	Equatorial diameter (cm)	Polar diameter (cm)	Neck thickness (cm)	Bulb circumference (cm)	100 bulb weight with leaves (g)	Sets or seedlings produced/kg onion seed (kg)	Number of sets or seedlings/kg weight basis
N-53 (Seedling)	1.5	2.5	0.5	2.6	124.5	50.4	803.2
N-53 (Set)	1.4	2.2	0.2	3.5	96.8	47.5	1033.1
AFDR (Seedling)	0.9	2.2	0.3	2.1	117.5	44.8	851.1
AFDR (Set)	1.1	1.9	0.2	3.2	78.6	48.0	1272.3
FP*	2.4	2.6	0.3	5.5	510.0	138.5	196.1
CD (P=0.05)	0.2	NS	NS	0.3	38.8	2.7	41.1

**FP = Farmer's practice in which sets of large size were used as planting material*

Table 2. Performance and economics of *Kharif* onion crop raised through sets and seedling.

Variety	Plant stand (%)	Plant height (cm)	Number of leaves/ plant	Bulb diameter (cm)	Average bulb weight (g)	Marketable yield (q/ha)	Gross Return (Rs per ha)	Net Return (Rs per ha)	Benefit: cost ratio	Sprouting of bulbs in storage (%)
N-53 (Seedling)	70.5	46.0	9.5	5.5	63.85	131.5	131500	90406	3.2	14.8
N-53 (Set)	98.2	48.8	11.8	5.9	89.00	167.7	167700	121117	3.6	10.2
AFDR (Seedling)	68.8	44.9	9.2	5.4	68.23	138.0	138000	94875	3.3	16.0
AFDR (Set)	99.0	50.2	10.2	6.2	97.28	170.6	170600	124492	3.7	11.5
FP*	76.8	58.9	9.5	4.8	61.05	149.6	149600	101342	3.1	11.8
CD (P=0.05)	2.6	0.8	0.3	0.2	3.82	8.7	-	-	-	0.8

the storage structure (Phogat *et al.* 1989, Singh *et al.* 1991 and Som *et al.* 2003). Accordingly, number of leaves per plant was higher in crop raised through sets as compared to seedling.

Marketable bulb yield was highest in variety AFDR raised through sets followed by N-53 through sets which was about 13% higher than farmer's practice and around 20% over seedling raised crop. The gross return, net return and B:C ration of onion crop raised through sets was highest as compared to farmers practice as well as crop raised through seedlings. Minimum sprouting of bulbs during storage was noticed in bulbs produced through sets in comparison to bulbs produced through seedlings in both the varieties.

Among weed management treatments, integrated weed management practice comprised of application of pendimethalin or alachlor @ 1.0 kg/ha as pre-plant application followed by one hand weeding after 40 days of planting resulted in significantly higher bulb yield over all other treatments including sole application of herbicides and hand weedings alone (Table 3). The higher yield in the integrated weed management system was the result of low weed population compared to other treatments. Since, onion is a shallow rooted crop, management of crop-weed-competition in the early stages of crop growth through weedicide application is important and weeds emerging at later stage can be taken care by hand weeding at 40 DAP. These results are in conformity with earlier workers Phogat *et al.* (1989), Singh *et al.* (2015), Rathore and Shekhawat (2004) and Manisha *et al.* (2005).

It can be concluded that for kharif season onion cultivation through sets was the most suitable practice for obtaining higher yield under low hill conditions of Himachal Pradesh. In addition, integrated weed management practice comprised of application of pendimethalin or alachlor @ 1.0 kg/ha as pre-plant application followed by one hand weeding after 40 days of planting was most effective in managing weeds which also resulted in higher bulb yield.

Table 3. Integrated weed management in *Kharif* onion variety N-53

Treatments		Weed population (No. per m^2)	Bulb yield (q/ha)	Increase in yield over control (%)
T_1	Pendimethalin @ 1.00 kg a.i. /ha	48.8	159.8	20.3
T_2	Pendimethalin @ 1.50 kg a.i. /ha	21.5	163.5	23.1
T_3	T_1 + HW at 40 DAP	12.0	176.0	32.5
T_4	Alachlor @ 1.00 kg a.i. /ha	40.0	168.6	27.0
T_5	Alachlor @ 1.50 kg a.i. /ha	15.7	170.9	28.7
T_6	T_4 + HW at 40 DAP	4.4	178.5	34.4
T_7	Two HW at 20 & 40 DAP	182.8	146.2	10.1
T_8	No weeding (control)	368.5	132.8	-
	CD (P=0.05)	26.2	4.8	-

HW-Hand weeding, DAP-Days after planting, Weedicides were applied as pre-emergence, weeds population recorded at harvest

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