Quality seed production of onion

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Onion (*Allium cepa* L.) is a major bulbous crop among the cultivated vegetable crops and it is of global importance. In India it has been grown in 0.52million ha with the production of 6.5 million tones (FAO, 2002). The productivity of onion in India is 12.5 t/ha, which is much lower than the productivity of USA (41.12 t/ha). The higher productivity of onion in USA is due to the growing of the long day hybrids and op varieties. The reasons for lower productivity of onion in India could be attributed to the limited availability of quality seed and lack of development of hybrids in onion are the major limiting factors among the others.

Status of requirements and supply of quality seed of onion in India; The estimated requirement of quality seed of onion is 3120t(assuming seed rate 6 kg/ha) during 2002 and out of that only 9.6 % of the demand is catered by public sectors organizations viz; NHRDF, NSC, ICAR institutes (IARI &, IIHR) and SAU's). The most of the demands of he quality seed was either meet by private sectors or unorganized program or own saved seed. Therefore, it is becomes important to increase the supply of quality seed through the efficient use of the technology. On the other hand sincere efforts should be made for the developed and release of hybrids.

Potential areas for seed production; In India, the short day types of onion is cultivated on large scale in the northern plains, central and southern part of the country expect higher hills where the long day types onion varieties like Brown Spanish and Yellow Spanish etc.are grown over a limited area. Therefore, the seed production of the short day types of onion is done in central part of the country particularly in Mandore and Khandawa region of MP, Nasik and Pune of MS and Rajcoat district of Gujarat.However, Northern state like Punjab, Haryana and Rajeshthan are not preferred by the seed industry due the sever attack of stemphylium and purple blotch and lower seed yield but there is a potential for seed production in north under delayed planting.

Land requirement;

Land to be used for seed production of onion should be free from volunteer plants. Although onion can be grown nearly in all types of soil from sandy loam to heavy clay

soil, but clays are not satisfactory unless well supplied with humus to lighten them. The soils pH should preferably be 6.0-6.8.

Isolation;

Onion seed field shall be isolated from contaminants viz; fields of other varieties and the fields of the same variety not confirming to varietal purity requirement for certification at least 5 m for foundation seed and certified seed during months bulb production and 1000 m and 500 m for foundation and certified seed production respectively during seed production.

However, the maximum permissible limit for bulb not confirming to the varietal characteristics is 0.10 percent and 0.20 percent (by numbers) for foundation and certified seed durng mother bulb production .The maximum permissible limit of off- types is 0.1% and 0.2% for FS and CS at and after flowering during seed production.. Onion seed crop must also is isolated from any flowering multipliers types of onion and shallots.

Nutrition

The ratio of N: P: K applied during seedbed preparation should be1: 2:2 but the nitrogen ratio can be increases according to the status of the soil. Very limited work has been reported on the effects of nutrition in the first year on seed production in the second year. Ahmed (1982) showed that application of N: P: K @ 150 kg ha^{-1} produced the largest bulbs and highest total bulb yield at the end of first year and that supplementary N application not exceeding 100 kg/ha in second year applied during anthesis enhanced seed quality. Higher levels of N increased the seed yield both at the expense of seed quality. The high K levels during bulb production were carried over to the second year and enhanced seed quality.

During, mother bulb production the deficiency of copper or manganese should not be allowed. The deficiency of copper is indicated by bulbs of poor colour with thin, fragile scales that come off in handling. Therefore, the application of 80-120 kg powdered copper sulphate control the deficiency.

Irrigation

Hawthorn (1951) found that high soil moisture in the seedling year performed high seed yields. Borgo et al. (1993) reported that water stress during bulb sprouting and beginnings of the anthesis reduce the number of umbels and flowers/plant. However, in

practice, the soil surface should not be continuously wet because it will predispose the crop to infection to root rot/damping off.

The methods of irrigation also greatly influence the seed yield and seed quality of onion. Tomar et al. (2004) observed that drip method of irrigation gave higher seed yield (894.94 q/ha) than the surface irrigation (648.94 q/ha) in onion cv. Pusa Madhvi. The seed vigour index is also higher in drip (876.49) than surface (663.71) irrigation in onion cv. Pusa Madhvi

Floral biology and pollination;

Anthesis occurs in early morning (6-7 hrs). Anther dehiscence is between 7.00 and 17.00 hr and on next day also with peak between 9.30 and 17.00 hr. Pollen fertility is higest on the days of anthesis. Stigma receptivity is also high on the day of anthesis (Jones, 1933). The duration of anthesis is approximately 4 weeks on individual umbel. The anthesis begins from outer flowers and goes centerally in succession. The flower is protandrous in nature and stigma becomes receptive when shedding of pollen is over.

Onion is cross- pollinated in nature and bees, flies and other insects do pollination. It is essential to ensure that there is sufficient population of pollinating insects to achieve the full potential of onion seed. It is also possible in some situation to encourage the development of increased blowfly population by distributing suitable carrier or dried fish among the flowering crop (Currah and Proctor, 1990).

Method of seed production

There are two methods of seed production. The seed to seed and bulbs to seed methods and both the methods are in use in onion seed production. But bulb to seed method is most commonly used method of seed production.

a) Bulb to seed method: In this method, the seed is sown in raised bed at 4-5 cm spacing for raising the seedling. The seedlings of 12-15 cm length are transplanted and this height attained 7-8 weeks after the seed sowing. Thus, 6-8 kg seed ha^{-1} is sown. The seedlings are transplanted in previously developed beds in 15x10 cm spacing. The weedicides (Stomp) is sprayed after the transplanting and followed by irrigation to check the growth of the weeds in early crop growth stage. The recommended cultural practices followed to raise healthy bulb crop.

The bulb are lifted when the 75% plant show neck fall/top die down. The bulbs are dried/curing under naturally ventilated place then neck is trimmed leaving 2-3 cm attached with bulb. The bulbs are roughed at this stage based upon the colour, shape and size. The damaged, twin bulbs and long necked bulbs if any are discarded. The medium size bulbs weighing (50-80 g) bulbs are selected and stored. The bulbs are and examined again before replanting in the following season.

One hectare of bulbs from the first year will plant3-5 ha for the seed production,. The bulbs selected for seed production and usually referred to as mothers bulbs. However, the area coverage is greatly affected by storage method and losses occur during storage.

The storage temperature also influences seed yield. The temperature ranging from 4.5 to 14^0C with an optimum of about 12^0C is the best for the storage of mother bulbs that are to be planted for seed production. The plants from such bulbs produce early and heavy yield than those grown from bulbs that have been stored at higher or lower temperature. The roots of the bulbs should be left intact after harvest.

The 1\3 parts of the bulb are cut before planting to examine the number of glumes, which is related to the compactness, and shape of the bulbs. More the number of glumes flatten the shape and poor the storability. To avoid rotting due to fungal infection of the bulb in field, Bavistin 10 gm in 10 lit of water is used for dipping the bulbs before planting. This should be practice in NS/BS seed production

b) Seed to seed method: In this method seedlings are transplanted in first week of October and allow over-wintering at the same place and allowing bolting (flowering). The seed are threshed from the mature umbel. This method does not allow to examine the mature bulb characters and field is rogued for off-types. Seed to seed method is not popular, since all the variety are not suitable for annual seed production due to poor bolting habit and lower seed yield. The seed produced in this method is not suitable for further multiplication.

Time of planting; The time of planting has great impact over the seed yield and incidence of the disease. Whenever the seed crop is planted in first fortnight of October is subjected to the heavy incidence of diseases and resulting poor seed yield. Tomar and Negi (2002) has recorded the highest seed yield of 576.80kg/ha with low incidence of diseases and better seed quality in cv. Pusa Madhavi in 15^{th} November planting during

rabi 1999. However, the higher seed yield (1251.66kg/ha) with complete escape from the incidence of disease in cv. Pusa Red was recorded during rabi2000.

Bulb weight and size; The bulb weight has markedly influenced the seed production in onion. The increases in bulb weight an increased the seed yield. Although an increase in wt. and size of bulb results in higher seed yield, but very large size bulbs (<90gm) if used will need a very high seed rate (60q/ha). Large size bulbs (3-4 cm diameter) and weighing <90gm may seed yield 10.00q/ha, Choudhary (1967).

Field inspection; Field inspection is arranged at mother bulb production and seed production stage.

(a) **Mother bulb production stage**: A minimum of two inspections shall be made as follows;

-The first transplants shall be made after transplanting of seedlings in order to determine isolation, volunteer plants, off type including bolters and others.

-The second inspection shall be made after the bulbs have been lifted to verify the true to type ness.

b) **Seed production stage;** A minimum of four inspection shall be made as follows.

-Before flowering for isolation, volunteer plants, off types including bolters.

- The 2^{nd} and 3^{rd} inspection at flowering to check the off type etc.

-Fourth at maturity to verify the true nature of plant and other relevant factors.

Production of hybrid seed; The hybrid evaluation have been developed using cytoplasmic male sterility viz, Arka lalima and Arka Kirtiman. The hybrid seed is produced by planting the male and females both in row is 2:8 (Currah, 1981). The planting ratio is depend upon the pollen production ability of male and pollinating agents especially *Apis melifera*. The problem of asynchrony in flowering can be eliminated by adjusting either the strong temperature of the mother bulbs or staggered planting (Atkin and Davis, 1954). The seed harvested from female rows is used as hybrid seed.

Harvesting: Traditionally onion seed heads are harvested by hand when 5-10% of the capsules on individual heads expose the black seed. The harvesting of seed heads at proper maturity is essential, other-wise the seed heads shatter the seed readily.The

harvesting of seed heads should be based upon the experience and the local weather conditions.

The seed heads are cut with 10-15 cm of (seed stalk) attached with head. When heads are cut are supported in the palm of hand and held between the fingers to avoid the loss of seed. The mature heads are harvested in two to three times. The harvested umbels are heaped for a few days drying before threshing the seed. But heap should not exceed 20-30 cm and should be turned each day.

The onion seed crop can be harvested directly with harvester. The best time for mechanical harvesting is when the seed dry matter content is of 60-70%. It is evident from the experience of the Israel the seed losses are high in direct harvesting and threshing.

Threshing and cleaning: The material is ready for threshing as soon as it is dry and the seeds can be separated from their capsules by rubbing in the hand. Over drying may damage the brittle seed. Threshing can be done through rolling, threshing machine or combines. Onion seeds may be damaged during processing and therefore frequent check should be made to ensure that sees coat are not accidentally cracked during any operations. It can be confirmed through the examination of hand lens. The another point which need to be ensured that the threshing does not break too many of the flower pedicels from their stalk as these are difficult to separate from the seed lot in subsequent seed cleaning operation.

Seed cleaning, drying and packaging: The cleaning is achieved with an air screen machine and further upgrades the physical appearance and seed quality than seed lot should pass through the gravity separator or by floatation. In floatation process, it should not be exceed more than 3 minutes. The heavy seeds sink and poor quality seed/pedicels float off.

The final seed lot must be dried down to moisture content not exceeding 12% or lower depending on the method of storage and packaging. When seed has to be packed in porous containers (cloth bag/paper bag) than seed moisture should not be >8% whereas packaging in moisture proof containers the seed moisture should be 5-6%.

Seed yield and 1000 seed weight; The seed yield from 700-1000 kgha^{-1} under ideal contitaions. The seed yield of F1 hybrids is usually much lower than the variety and is often range from 50-100 kg ha^{-1}. The 1000 seed weight is 3.6 gm. The seed standard is given below in table 1.

Table. Seed standard for onion variety and hybrid

Factor	Standard for each	
	F.S	C.S
Pure seed	98.0%	98.0%
Inert matter (maximum)	2.0%	2.0%
Other crop seed (Maximum)	5/kg	10/kg
Weed seed (Maximum)	5/kg	10/kg
Germination (Minimum)	70%	70%
Moisture (maximuu)	8.0%	8%
For vapour proof containers (Maximum)	6.0%	6%

Major pest and seed borne diseases; The number of insect and diseases attacks the onion bulb and seed crop. The major insects and diseases are given in table 2.

Table.2 Major pest and seed borne diseases of onion

S.No.	Name	Scientific name	Remark
Pest			
1.	Thrips	*Thrips tabaci*	Thrips multily in high during March to April both on seed as well as bulb. Spray the malathion or nuvacron
2.	Head borer	*Heliothis armigera*	Polyphagous pest of tropics, spray of endosulphan 2-3ml/liter of water with sticker.
3.	Onion Maggot	*Hylemia antiqua*	Application of thimet and crop rotation is effective
4.	Mites	*Rhizoglyphus spp*	Dusting of the sulphur@ 22kg/ha
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Major diseases			
1.	Purple blotch	*Alternaria porri*	Spray of dithane –M45 at 0.25% or ridomil or 1gm/liter of water
2.	Stemphylium blight	*Stemphylium vesiearium*	-do-
3.	Downey mildew	*Perenosporus destractor*	Sprying of zineb @0.2% with sticker @1ml/liter of solution
4.	Smut	*Urocyctis cepulere*	Crop rotation being soil borne and set/bulb treatment with thiram
5.	Neck rot	*Botrytis allii*	Keep 2-3cm neck to escape

6.	Grey mold	*Botrytis cineria*	Kept the bulbs at proper ventilation/storage
7.	Yellow dwarf virus	-	Control the vector
8.	Onion mosaic virus	-	-do-
9.	Basal rot	*Fusarium* Spp	Five year crop rotation with unrelated crop

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