

## **EFFECT OF CULTURAL PRACTICES ON SEED YIELD OF BIG ONION (*Allium cepa* L.)**

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### **ABSTRACT**

Unavailability of quality seeds of recommended cultivars is the major constraint to increase local production of onion in Sri Lanka. Big onion seeds can be produced locally, but seed yields are very low due to various reasons. Purple blotch disease is one of the major reasons for low yield in the *maha* season. Heavy rains as well as dew formation on leaf surfaces during night increases severity of purple blotch disease of onion. Therefore, studies were carried out during two seasons to test the possibility of reducing the disease incidence by using different crop management practices and thereby obtain higher seed yields. Results of both seasons indicated that covering the crop at night and during rainy periods by using a white polythene gave lowest severity of purple blotch disease and the highest seed yield of onion. Spraying of recommended fungicides and spraying sulphur at ten day intervals also gave lower severity of disease and higher seed yields compared to control treatment. Removal of dewdrops by spraying water early in the morning did not help to reduce the severity of purple blotch as compared to other treatments tested. The lowest seed yield and the highest disease severity were observed in control treatments. Number of flower stalks per plant and umbel diameter varied significantly between the treatments.

**KEYWORDS:** Dew formation, Onion, Purple blotch, Seed yield

### **INTRODUCTION**

Big onion (*Allium cepa* L.) is an important cash crop in Sri Lanka. It is used as an essential ingredient in seasoning dishes and is consumed either fresh or cooked form. The estimated total annual big onion requirement is around 124,000 t (DOA, 2002).

In the 1970's, the extent and production of big onion were insignificant. Later the extent and the production increased considerably. However, the average yield is low at about 10-13 mt/ha as compared to the average yield of other countries (DOA, 2002). Several constraints prevent farmers in Sri Lanka from obtaining high onion yields. Unavailability of quality seeds is one of the major constraints to increase onion yields. Poor quality seeds imported by unauthorized means from India create problems such as poor germination, poor bulbing, high thick neck percentage and low yield. Therefore, importation of quality seeds from known sources or production of quality seeds locally is important to overcome this problem.

Priliminary field studies conducted by the authors revealed that some varieties such as Pusa Red and Rampure are suitable for bulb production as well as for seed production locally, but seed yields are very low due to various reasons. Weather conditions such as high rainfall, high RH and dew formation prevailing in the *maha* season are unfavorable for onion. Therefore, the crop is highly subjected to diseases, mainly the purple blotch disease, caused by fungus *Alternaria porri*. It leads to a significant yield reduction and production of poor quality seeds (Gupta *et al.*, 1991). However, this is the only period that planting material for seed crop is readily available. The objective of this study was to identify better crop management practices to reduce the disease incidence and to increase the seed yield of onion.

## MATERIALS AND METHODS

Experiments were conducted in two seasons at Field Crop Research and Development Institute (FCRDI), Mahailuppallama. Well-cured, medium sized bulbs (50-60g) of variety Pusa Red were selected for this study and were vernalized for a three-week period before planting. Bulbs were planted in 0.9 m x 3 m raised beds at spacing of 22.5 cm x 22.5 cm. Following treatments were arranged in Randomized Complete Block Design with three replicates.

### Treatments

1. Spraying water to the crop early in the morning to remove the dew drops- Spraying water onto the crop was done by using watering bucket at the rate of 5 l/plot early in the morning at about 6.00 a.m.
2. Covering the crop with white polythene at night and at rainy times- covering the crop by white polythene was practiced two weeks after planting. Arch-shaped structures, 1 m width, 3.5 m length and 1.5 m height (at the middle) were prepared by using wooden sticks over each plot and these were covered by white polythene (200 gauge), keeping considerable space (about 50 cm) between the soil level and edge of the polythene for proper ventilation. Polythene was fitted to the structures by using coir ropes for easy removing and covering.
3. Spraying sulphur at two-week intervals. (4 sprays)- Wettable sulphur was sprayed at two week intervals at the rate of 50 g /10 l starting from 2 weeks after planting.
4. Spraying recommended fungicides for purple blotch disease at two week intervals (4 sprays)- Application of fungicides was started two weeks after planting and continued until flower opening. Mancozeb 80% WP at the rate of

20 g/10 l was applied for the 1<sup>st</sup> and 4<sup>th</sup> spray, Daconil (Chlorothalonil 70% WP) at the rate of 20 g/10 l was applied for 2nd spray and Folicur (Tubaconazole 250 EC) was applied at the rate of 4 ml/10 l for the 3<sup>rd</sup> spray.

5. Un-treated control - Before planting, all plots were fertilized with P and K at the rate of 45 kg of P<sub>2</sub>O<sub>5</sub> and 30 kg of K<sub>2</sub>O ha<sup>-1</sup> as a basal dressing in the form of Concentrated Super Phosphate and Muriate of Potash. Nitrogen was applied at the rate of 23 kg ha<sup>-1</sup> as Urea at 1 week after planting (WAP) and additional N and K were applied at the rate of 23 kg ha<sup>-1</sup> N and 15 kg of K<sub>2</sub>O ha<sup>-1</sup> in the form of Urea and Muriate of Potash respectively at 6 WAP. Beds were irrigated at 4-5 day interval. Hand weeding was practiced at 2 and 5 WAP. Insecticide Carbaryl 85% WP was sprayed to control thrips at 3 weeks after planting. Fungicides used in this study were selected according to recommendations of the Department of Agriculture (DOA, 1990).

Data on umbel diameter, number of flower stalks per plant, seed yield and disease severity were collected. These data were subjected to the analysis of variance (after appropriate transformation when necessary) and the treatment means were compared using DMRT at p= 0.05 using the statistical package MSTATC developed by the Michigan State University, U. S. A.

Disease severity index (DSI) of purple blotch was recorded at seed setting stage. Ten plants were randomly selected from each plot. All leaves of these plants were excised and disease scoring was done on a 1-9 standard rating scale as follows.

#### Rating scale for DSI of purple blotch

Rating scale	% Leaf area infected
1	< 1
3	1-5
5	6-25
7	26-50
9	>50

The percentage disease severity index (DSI) for purple blotch was calculated using the following formula.

$$\text{DSI (\%)} = \frac{\text{Total sum of numerical ratings}}{\text{maximum disease rating} \times \text{no. of observations}} \times 100$$

## RESULTS AND DISCUSSION

Results showed that DSI of purple blotch disease was high and it varied from season to season and between treatments. Major constraints in onion seed production in *maha* season are crop damage due to high rainfall and severe development of purple blotch disease caused by *Alternaria porri*. Results in *maha* 1996/97 showed significantly higher seed yield and lower purple blotch severity in the treatment of covering the crop by polythene at night and rainy time as compared to all other treatments tested. In *maha* 1997/98, same treatment gave significantly higher seed yield and lower purple blotch severity compared to control treatment (tables 1 and 2). In both seasons the highest seed yield and the lowest disease severity were recorded in this treatment. Purple blotch disease is mainly a leaf disease and it spread to flower stalks as well as florets of the umbel. Warm, humid conditions (optimum temperature 22<sup>0</sup>-25<sup>0</sup> C and RH 90%) favour its spread; approximately 6 hours of free water or persistent dew on leaf surface is needed before sporulation takes place (Brewster, 1994). Spore sporulation of purple blotch is reported to be maximum, immediately after rains and early in the morning (Khare and Nema, 1984). Weather data in Table 3 indicated that rainfall pattern during seed crop growing period in the dry zone is more favorable for purple blotch development. In general, continuous rain over 6 hours, high RH (70 -90%) and air temperature of about 20<sup>0</sup> to 33<sup>0</sup> C can be observed during the period between December to April. The lowest disease severity in the treatment of covering the crop by polythene may be due to protection of the crop from rain and dew formation. Muro *et al.*, (1991) showed that there was a considerable yield sensitivity of onion to distinct degrees of leaf damage. Therefore, the highest number of flowers per plant, the highest flower diameter and the highest seed yield in the treatment of covering of the crop by polythene during night and rainy period may be due less leaf damage resulted from low purple blotch severity.

It has been reported that considerable amount of purple blotch control could be achieved by spraying suitable fungicides onto the onion crop (Gupta *et al.*, 1991). Results of this study showed that spraying of recommended fungicides, starting from 2WAP until flower opening resulted in significantly lower disease incidence compared to control in the 1996/97 *maha* season but not so in the 1997/98 *maha* season. Accordingly, significantly higher seed yield was observed in the fungicide treated treatment over control in the 1997/98 *maha* season but not in the 1996/97 *maha* season (tables 1 and 2). It may be due to differences of DSI and rainfall pattern in both seasons. Spraying of fungicides for protection of the standing crop has been extensively studied in India. It is reported that spraying should be started as soon as the first lesions are noticed or before the seed stalks appear (Singh, 1985). Gupta *et al.*, (1986) reported that highest net profit from seed crop was obtained

when 0.25% Dithane M-45 were applied, four times at 15 day intervals starting just after disease appearance. Sharma, (1986) found that three sprays of 0.2% Mancozeb gave good control of purple blotch of onion. Gupta *et al.*, (1991) reported that in wet season bulb crop, three sprays of Mancozeb at 7 days interval had minimum purple blotch disease incidence and maximum yield. Sirivastava *et al.* have reported similar results, in 1991. In this study, recommended fungicides- Mancozeb was applied for 1<sup>st</sup> and 4<sup>th</sup> spray, Daconil was applied for 2<sup>nd</sup> spray and Folicur was applied for 3<sup>rd</sup> spray to control purple blotch. However, consistent results were not observed by the fungicide treatment in both seasons.

Data of DSI of spraying of sulphur treatment at two weeks intervals also showed similar results to that of fungicide application. However, significantly higher seed yields could be obtained in this treatment over the control in both seasons (tables 1 and 2). Although sulphur is not a recommended fungicide for purple blotch disease it has a fungicidal effect on some pathogens (DOA, 1997). In addition, spraying of sulphur develops a thin sulphur-coat on the leaf surface, which could act as a protective barrier against pathogen infection. Spraying fungicides to develop a waxy cover on flower stalks of onion for control of *Stemphylium* blight has been reported from Israel (Currah and Proctor, 1990).

Treatment of spraying water early in the morning was practiced in this study to wash-off the dewdrops from the plants because this practice is normally followed by farmers to protect the red onions crop from tip burn. However, in the present study this method did not help to reduce the purple blotch disease. Number of flowers per plant and umbel diameter reduced when disease severity was high (tables 1 and 2). It was observed that development of purple blotch patches on flower stalks lead to flower stalk breakage at the weakened points on the stem. This disease can also kill the seed head partially or completely. The lowest seed yield, the lowest flower stalks/plant and the lowest umbel diameter are in control treatment.

**Table 1. Effect of different treatments on disease severity of purple blotch, no. of flowers/plant, umbel diameter and seed yield of big onion during maha, 1996/97.**

<i>Treatments</i>	<i>Disease Severity index (8WAP)**</i>	<i>No. of flowers /plant</i>	<i>Umbel diameter cm.</i>	<i>Seed yield (kg/ha)</i>
Spraying water early in the morning	44.9ab	4.5c	5.3b	438.5bc
Spraying S, 10 days interval	40.3bc	4.8bc	6.5a	457.9b
Covering by polythene at night	34.3d	5.8a	7.1a	563.7a
Spraying fungicides, 10 days interval	39.9bc	5.3b	7.0a	447.1bc
Control	48.4a	3.1d	5.7b	393.1c
CV%	4.7	8.1	15.2	12.0

\*Values followed by same letters are not significantly different at p=0.05.

\*\* Arc Sine transformed data were subjected to analysis.

**Table 2. Effect of different treatments on disease severity index of purple blotch, no. of flowers/ plant, umbel diameter and seed yield of big onion during maha 1997/98 at, Maha-illuppallama.**

<i>Treatments</i>	<i>Disease severity index (8WAP)**</i>	<i>No. of flowers /plant</i>	<i>Umbel diameter (cm)</i>	<i>Seed yield (kg/ha)</i>
Spraying water early in the morning	25.3ab	4.4c	5.5c	474bc
Spraying S, 10 days interval	22.7abc	4.7bc	6.6b	519ab
Covering by polythene at night	18.2c	5.7a	7.7a	591a
Spraying fungicides, 10 days interval	22.6abc	5.0b	6.8b	524ab
Control	30.7a	4.0d	5.5c	421c
CV%	9.1	8.1	12.5	10.7

\*Values followed by same letters are not significantly different at  $p=0.05$  by the DMRT

\*\* Arc Sine transformed data were subjected to analyze

**Table 3. Rainfall (mm) and rainy days during December to April period in maha 1996/97 and maha 1997/98 season at, Mahailuppallama.**

<i>Rainfall (mm) and rainy days</i>					
<i>Seasons</i>	<i>December</i>	<i>January</i>	<i>February</i>	<i>March</i>	<i>April</i>
1996/97	77.1(16)	9(2)	13.2(1)	29.4(3)	202.7(17)
1997/98	370(18)	141(7)	0	150.2(2)	129(7)

Source: Meteorological unit, FCRDI, Mahailuppallama; Numbers within parenthesis indicate the number of rainy days

## CONCLUSION

Covering of onion seed crop by white polythene at night and during rainy periods can be used as a cultural practice to minimize crop damage due to rain and purple blotch disease and to obtain higher seed yield.

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