Effect of Polypropylene Covers on Frost Protection and Yield of Potato Crop

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ABSTRACT

Acyclic frost occurs in potato growing belt of Punjab *i.e.* Hoshiarpur, Jalandhar, Kapurthala and adjoining districts which causes huge losses to potato. It severely affects the formation and development of potato tubers. The present study was conducted during the year 2011-12 to find solution of this region specific problem. Three practices evaluated in this study were i) irrigation irrespective of the frost, ii) light irrigations on occurrence of the frost and iii) covering the crop with non-woven polypropylene film after 50 days of sowing and the film was removed after 40 days. The parameters studied were crop damage due to frost, grade of tubers and total yield. The yield was significantly higher (301 q/ ha) in covered potatoes as compared to plots without covering (255 q/ ha and 225 q/ ha). The covering also affected the size of tubers as higher quantity of medium and large sized tubers (83%) were obtained with covering while out of total tubers only 64 to 69 per cent tubers fell in these two categories where potatoes were left uncovered.

Keywords: Frost, Non-Woven, Polypropylene, Potato, Yield.

INTRODUCTION

Potato occupies 13,217 ha. area which is about 50 per cent of the total area under vegetables in the district Hoshiarpur. There are three sowing times for potato crop in the district, early crop (planted in September), main crop (end October-November planting) and one in spring season. The potato tubers produced in Punjab especially North western districts are marketed as seed in other States as the temperature remains low in Punjab which results higher yield and quality. However the severe cold and acyclic frost occurs in Punjab which causes huge damage especially to fruits and vegetables. Early crop (September-November) escapes frost as farmers plant this crop in September and harvest after 60 days in the month of November but late sown main crop of autumn and early sown spring crop is damaged due to frost in the months of Jan-Feb. The potato tuber yield depends to a higher degree on the rate and duration of the tuber growth. Potato production for an early crop is dependent on the climatic conditions in the vegetative period, especially temperature (Sale 1979, Lachman et al. 2003). The change of conditions of the initial growth and development of potato plants by covering influences not only the yield level, but also tuber quality (Nelson and Jenkins (1990). The use of covers directly on the planted field enables to enhance the harvest of early potato tubers and reduce the variability of the yield.

MATERIALS AND METHODS

The effect of nonwoven polypropylene covering on the frost protection and tuber yield of potato was investigated. The experiment was carried out in the year 2011-12 on three locations in different frost prone villages selected on the basis of previous experience in district Hoshiarpur. The field was well prepared after addition of recommended dose of farm yard manure i.e. 50 t/ ha. Chemical fertilizers, that is, Diammonium phosphate @129 kg, Urea @177 kg and Murate of potash @100 kg/ ha. were applied as basal dose at time of planting. The field experiment was established in the randomized complete blocks design, in three replications and on three locations. Pre-sprouted seed potatoes treated with Emisan-6 of Kufri Pukhraj cultivar were planted on the 29th October at spacing of 20 cm in row and 60 cm between rows, and. First irrigation was given after

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5 days of planting. Remaining dose of Urea @ 200kg/ha was broadcasted before earthing up the crop after 40 days of sowing. The treatments consisted of

i) Irrigation irrespective of the frost, (P1)

ii) Light irrigations on occurrence of the frost (P2) and

iii) Covering the crop with non-woven polypropylene film after 50 days of sowing and the film was removed after 40 days (P3).

The potato crop was covered with polypropylene sheet (17gsm) on occurrence of light frost. There was severe frost in the month of January. This film was removed on 30 January and the crop was harvested on 10th February 2012. The data regarding the damage percentage (calculated by counting number of plants died due to frost) and yield were recorded. The tubers were further graded into three sizes viz. large (more than 50g), medium (25-50g) and small (Less than 25g) to analyze the effect of frost on tuber size.

Table 1. Effect of frost protection measures on plant damage (%)

Treatment	Extent of Damage (%)			
	L 1	L2	L3	Mean
Irrigation irrespective of the frost (P1)	30.5	29.3	24.9	28.2
Light irrigations on occurrence of the frost (P2)	22.5	21.6	19.7	21.2
Covering the crop with polypropylene film (P3)	13.0	12.2	8.9	11.4
Mean	22.0	21.0	17.8	
CD at 5% for Treatments =1.42 , Locations =1.42, Treatment x Location= NS				

Table 2. Effect of frost protection measures on yield.

Treatment	Yield (q/ha)			
	L 1	L2	L3	Mean
Irrigation irrespective of the frost, (P1)	215.4	227.8	232.3	225.2
Light irrigations on occurrence of the frost (P2)	249.3	251.0	265.3	255.2
Covering the crop with polypropylene film (P3)	284.7	304.7	313.8	301.1
Mean	249.8	261.2	270.4	
CD at 5% for Treatments =6.9 , Locations =6.9, Treatment x Location= NS				

Table 3. Effect of frost protection measures on marketable yield of tubers (%)

Treatment	L 1	L2	L3	Mean
Irrigation irrespective of the frost, (P1)	63.2	64.5	66.6	64.8
Light irrigations on occurrence of the frost (P2)	67.4	69.0	70.1	68.9
Covering the crop with polypropylene film (P3)	82.8	83.6	85.2	83.9
Mean	71.1	72.4	74.0	

Benefit cost ratio:

Treatment	Marketable yield (q/ha.)	Increase in yield over P1 (q/ha.)	Additional profit over P1 (Rs)*	BC Ratio over control **
Irrigation irrespective of the frost, (P1)	145.9	0	0	1
Light irrigations on occurrence of the frost (P2)	175.8	29.9	11960	2.134
Covering the crop with polypropylene film (P3)	252.6	106.7	42680	1.536

***** Average price of potato over past three years= Rs 400/- per q.

** Cost of non-woven pp film for one hectare= Rs 20,000/-

The results of the experiment were analyzed statistically by means of analysis of variance using randomised block design (Singh *et al 1991*).

RESULTS AND DISCUSSION

The adverse climatic conditions caused quantifiable damage to the crop, resulting in reduced tuber yield as well as marketable yield in all the three locations. It is evident from Table 1 that maximum damage (30.5%) was under practice 1 where no special protection was given to crop at location 1 whereas minimum damage (8.9%) was observed in practice 3 where the crop was kept covered during the period of frost occurrence at location 3. The average plant damage percentage of three locations was significantly higher in practice 1 (28.2%) over the practice 2 (21.2%) as well as practice 2 (11.4%). Thus use of the covers with non woven propylene film in the potato cultivation provided effective protection from frost and resulted in significant reduction in the plant damage. An increase in the tuber yield as a result of covering was obtained in the potato cultivation under polypropylene film in comparison with the traditional cultivation. The tuber yield (Table 2) was maximum (313.8 q/ ha.) in practice 3 at location 3 whereas minimum (215 q/ ha.) in practice 1 at location 1. The mean yield of 301.1 q/ ha. was obtained from the covered crop which was significantly higher over the practice I and practice II, 225.2 q/ ha. and 255.2 q/ ha. respectively. The high yield under the protection was probably due to frost protection afforded by covering and creation of favourable microclimate for plant and tuber growth.

The nonwoven polypropylene covering also affected the share towards the marketable tuber yield (Table 3). The quantity of marketable sized tubers was 83.9 percent in practice 3 which was 1.73 times higher over the practice 1 and 1.43 times more than practice 2. There is significant variation in tuber size in different locations, which may be due to variation of soil type, fertility level, crop rotation and other cultural practices. The interaction of the practices and location was non-significant which reveals that the propylene film covering has its effect in increasing the tuber size in all the locations.

The costs of the early potato production under covers are considerably higher compared with the traditional method. At relatively high costs relating to the area unit, the production is profitable only when leading to obtaining sufficiently high yields which was the case in the present study (Table 4). The additional yields obtained in covered plots not only covered for additional cost incurred but also increased the profit over un-protected crop.

CONCLUSION

The non-woven polypropylene film covers were effective in protection of the crop from frost damage. The use of nonwoven polypropylene cover in the potato cultivation in frost affected areas has a favorable effect on the yield level and share in the yield of marketable tubers and thus it does not reduce the tuber quality.

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