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Studies on Black Scurf and Scab Diseases of Potato under Low Water Availability Condition in Coastal Plains of Odisha

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Abstract Potato crop has a high water requirement which is positively correlated with yield. The crop is irrigated at seven to ten days interval in the coastal zone of Odisha depending on the soil condition. In view of water constraints, the present experiment was designed taking two parameters (i) the irrigation treatments which were based on Cumulative Pan Evaporation (I) (ii) mulching (M). Irrigation schedules were practised as follows: I_1 = irrigation at 30 mm CPE, I_2 = irrigation at 35 mm CPE, I_3 = irrigation at 40 mm CPE, I_4 = irrigation at 45 mm CPE, I_5 = irrigation at 50 mm CPE and I_6 = irrigation at stolon formation, tuber initiation and tuber development stages of the varieties used. The mulching (M) schedules were M_1 : No mulch and M_2 : Mulching with paddy straw @ 5 t ha $^{-1}$. The trial was conducted in the year 2008-09 and 2009-10 following RBD design. The result revealed that black scurf was not recorded in irrigation with critical growth stage without mulch (I_6M_1) and irrigation with critical growth stage with mulch (I_6M_2). Minimum scab incidence was recorded in irrigation at 35m CPE with mulch (I_2M_2) followed by irrigation at 40 mm CPE with mulch (I_3M_2). Maximum yield (both marketable and non-marketable tubers) 31.92 t/ha was obtained in 35 mm CPE in mulching condition followed by the irrigation in 35mm CPE in no mulching condition (30.30 t/ha).

Keywords Black scurf, Scab, Water availability, Irrigation, Mulches.

Introduction

Potato is one of the most popular winter vegetable crops in Odisha and it is cultivated in all the districts. In *kharif* it is cultivated in undivided Koraput, Rayagada and Phulbani districts in the hilly tracts. Normally the crop has a high water requirement which is positively correlated with yield which is already established in chipping potato cultivars under West-Central Indian plains [1]. Excess irrigation increases production costs, some cases reduces yield by affecting soil aeration and root respiration that favors the occurrence of diseases. Frequency and intensity of irrigation as well as mulching has great influence on growth, yield and quality of potatoes which had already been established [1—3]. The crop is affected by a number of diseases, namely early blight, phoma blight, bacterial wilt, black leg, leaf roll and different types of mosaics in the growing stage. Brown rot, soft rot and common scab diseases are noticed at harvest. The incidence of black scurf varied differently in different locations of the country. It is an important disease in entire Madhya Pradesh, Bihar,

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Table 1. Incidence of black scurf and common scab in 2008-09 and 2009-10 (pooled). *Figures in parentheses are in $\sqrt{x}$ + 0.5 values. I_1 = irrigation at 30 mm CPE, I_2 = irrigation at 35 mm CPE, I_3 = irrigation at 40 mm CPE, I_4 = irrigation at 45 mm CPE, I_5 = irrigation at 50 mm CPE and I_6 = irrigation at stolon formation, tuber initiation and tuber development stages of the varieties used. The mulching (M) schedules were M_1 : No mulch and M_2 : Mulching with paddy straw @ 5 t ha^{-1}.

Treatments	Black scurf incidence (%)		Common scab incidence (%)	
I_1M_1	1.01	(1.23)	1.77	(1.57)
I_2M_1	0.82	(1.14)	2.00	(1.58)
I_3M_1	0.40	(0.95)	2.65	(1.77)
I_4M_1	0.14	(0.80)	3.55	(2.01)
I_5M_1	0.10	(0.77)	3.02	(1.88)
I_6M_1	0.00	(0.70)	2.68	(1.78)
I_1M_2	0.48	(0.98)	1.48	(1.40)
I_2M_2	0.36	(0.92)	1.45	(1.39)
I_3M_2	0.22	(0.84)	1.85	(1.53)
I_4M_2	0.16	(0.81)	2.24	(1.66)
I_5M_2	0.12	(0.79)	2.63	(1.76)
I_6M_2	0.00	(0.70)	2.36	(1.69)
SEm±	0.013		0.07	
	0.040		0.22	

West Bengal and eastern part of Uttar Pradesh. It is a serious problem in spring crop when the temperatures are ≥ 30°C. The incidence of black scurf disease cannot be overruled in Odisha conditions as soil temperature rises to 28° to 32°C towards the end of February. High soil moisture and high temperature are favorable for black scurf disease (Yada). In this context a trial was conducted during 2008-09 and 2009-10 in the experimental fields of All India Coordinated Research Project on Potato, Orissa University of Agriculture and Technology to study the incidence of both the diseases under different level of water availability conditions.

Materials and Methods

The experimental area is located at 20°15´ N latitude and 85°52´ E longitude and is about 60 km away from Bay of Bengal with an altitude of 25.5 m above MSL. The soil of the experimental area was sandy loam in texture with a pH of 5.6 and low in available N (228.4 kg ha^{-1}), medium in both available P (20.4 kg ha^{-1}) and available K (89.9 kg ha^{-1}). Kufri Jyoti with medium duration growing period was used as the test variety. A standard fertilizer dose, i.e. FYM 10 t ha^{-1} and NPK @ 150 : 80 : 100 kg ha^{-1} with a normal spacing of 60 cm× 20 cm. The treatments with a combination of irrigation and mulching were replicated four times in a complete randomized block design. Usually the potato crop is irrigated at around 10 days interval in the coastal zone of the state depending on the soil condition. In view of water constraints, in the present experiment the irrigation treatments were based on Cumulative Pan Evaporation (I) and mulching (M). Irrigation schedules were as follows: I_1 = irrigation at 30 mm CPE, I_2 = irrigation at 35 mm CPE, I_3=irrigation at 40 mm CPE, I_4 = irrigation at 45 mm CPE, I_5 = irrigation at 50 mm CPE and I_6=irrigation at stolon formation, tuber initiation and tuber development stages of the varieties used. The mulching (M) schedules were M_1 : No mulch and M_2 : Mulching with paddy straw @ 5 t ha. After harvesting the incidence of tuber borne diseases, namely, black scurf and scab diseases were recorded in the tubers.

Results and Discussion

The crop was harvested at 90 days after planting. The irrigation was stopped at 80 days after planting, i.e. 10 days prior to harvesting for proper curing. After harvesting cut, damaged rotted tubers were removed from the lot. The tubers were carefully examined for detection of black scurf and scab incidence. The result revealed that black scurf was not recorded in irrigation with critical growth stage without mulch (I_6M_1) and irrigation with critical growth stage with mulch (I_6M_2) (Table 1). It was indicated that mulching had no influence on the black scurf incidence rather application of irrigation at critical growth stage was very important. Among other treatments least incidence was recorded in irrigation at 50 mm CPE without mulching (I_5M_1) followed by irrigation at 50 mm CPE with mulching (I_5M_2). There was no significant difference between these two treatments, i.e. (irrigation at 50 mm CPE without or with mulch). Maximum incidence was recorded in I_1M_1 (irrigation at 30 mm CPE without mulch) followed by I_2M_1 (irrigation at 35 mm CPE without mulch).

Minimum scab incidence was recorded in irrigation at 35 mm CPE with mulch (I_2M_2) followed by irrigation at 40 mm CPE with mulch (I_3M_2). There was

Table 2. Total yield, non-marketable yield and marketable tuber yield (t/ha) in 2008-09 and 2009-10 (pooled). I_1 = irrigation at 30 mm CPE, I_2 = irrigation at 35 mm CPE, I_3 = irrigation at 40 mm CPE, I_4 = irrigation at 45 mm CPE, I_5 = irrigation at 50 mm CPE and I_6 = irrigation at stolon formation, tuber initiation and tuber development stages of the varieties used. The mulching (M) schedules were M_1 : No mulch and M_2 : Mulching with paddy straw @ 5 t ha^{-1}.

Treatments	Total tuber yield (t/ha)	Non-marketable tuber yield (t/ha)	Marketable tuber yield (t/ha)
I_1M_1	25.67	3.97	21.70
I_2M_1	30.30	4.35	25.95
I_3M_1	24.20	3.73	20.47
I_4M_1	22.19	3.43	18.76
I_5M_1	21.90	3.98	17.92
I_6M_1	18.48	4.48	14.00
I_1M_2	26.61	3.95	22.66
I_2M_2	31.92	3.94	27.98
I_3M_2	18.05	5.19	12.86
I_4M_2	25.45	5.11	20.34
I_5M_2	23.62	4.81	18.81
I_6M_2	21.17	4.65	16.52

no significant difference between these two methods, i.e. irrigation at 35 mm CPE and 40 mm CPE with mulch. Maximum scab incidence was recorded in irrigation at 45 mm CPE without mulch (I_4M_1) followed by irrigation at 50 mm CPE without mulch (I_5M_1). Moisture condition of soil influences scab incidence. It might be concluded that irrigation at critical stage had effect on black scurf incidence irrespective of mulching. In case of common scab mulching had influence along with irrigation at 35 mm CPE. It was indicated that in case of mulching scab incidence was significantly less. While considering yield of the tubers total tubers were graded into two types, i.e. marketable tubers (size was ≥ 50g) and non-marketable tubers (size was <50g). Maximum yield (both marketable and non-marketable tubers) 31.92 t/ha was obtained in 35 mm CPE in mulching condition followed by the irrigation in 35 mm CPE in no mulching condition (30.30 t/ha) (Table 2). Lowest yield (12.78 t/ha) was obtained in mulching condition in irrigation at 40 mm CPE (I_3M_2). Same trend was observed in case of marketable tuber yield, i.e. maximum yield (marketable tubers) 26.81 t/ha was obtained in 35 mm CPE in mulching condition followed by the irrigation in 35 mm CPE in no mulching condition (25.95 t/ha).

Selection of proper irrigation schedules and mulching practices in potato were important resource management tool in improving water use efficiency in areas with low water availability. Among different mulches the use of paddy straw mulch recorded higher yield than other mulches. It might already be concluded in areas with limited water availability in Assam application of irrigation in critical stages and mulching was helpful in obtaining higher yield reducing cost of cultivation by efficiently utilizing water [4]. Irrigation at 20 mm CPE had the best yield potential over other treatments which had already been tested in the variety Kufri Chipsona-1 with mulching followed by without mulching in central India [5]. Water is essential for increasing fertilizer use efficiency. Application of paddy straw also increased P uptake ultimately increasing potato yield [6, 7].

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