J. Mycopathol. Res. **43**(1) : 79-81 (2005)

Influence of organic manure, irrigation interval and cropping sequence on the yield and black scurf disease of potato

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All the organic manures such as Jaivic, neem cake, castor cake and mustard cake, applied with recommended dose of NPK, were positively correlated (r = + 0.7) with tuber yield and negatively (r = –0.6) with disease development in comparison to the check where only recommended dose of NPK was applied. Regarding disease development neem cake and karanze cake showed the best response indicating statistically similar result regarding reduction of disease incidence and intensity. Highest tuber yield of 265 q/ha was recorded when the crop was irrigated at the interval of 30 days alongwith recommended dose of NPK and minimum tuber yield was recorded when field was kept under rainfed condition. Maximum disease incidence (34.0) and intensity (2.4) were recorded when field was irrigated at the interval of 10 days and minimum when field was kept under rainfed condition. Highest tuber yield of 265 q/ha was recorded when potato was grown after urd bean while lowest yield of 236 q/ha was obtained when potato was grown after rice. The minimum disease incidence (5 per cent) and intensity (1.0) were recorded where potato was grown after kharif onion. However, potato grown after rice indicated the maximum incidence of scurfed tuber (15%) and maximum intensity (2.2) was recorded when potato was grown after potato.

Key words : Potato, black scurf disease, organic manure, irrigation, cropping sequence

INTRODUCTION

Potato (*Solanum tuberosum* L.) is the fourth important food crop after rice, wheat and maize. It is used as staple food cum supplementary diet in both developing and developed countries. India is a major potato cultivator. The standing crop in the field is attacked by a number of diseases and plants start drying or their capacity is reduced due to several diseases out of which black scurf disease caused by *Rhizoctonia solani* Kuhn contributes a major role. Farmers get only a portion of estimated yield. They face losses not only in the yield but also the tube quality and cost in raising the lost crop. The information on the effect of some epidemiological factors like organic manure, irrigation interval and cropping sequences on the yield of tuber and spread of *Rhizoctonia solani* is limited. In the present paper, important epidemiological aspects, in relation to the black scurf disease have been studied.

MATERIALS AND METHODS

The experiment was conducted at Tirhut College of Agriculture farm, Dholi (Muzaffarpur), a campus of Rajendra Agricultural University, Pusa (Samastipur) Bihar during winter (Rabi) season of 2001-2002. The experimental plot was upland and fairly uniform in topography and the soil was deep and well drained. All the three experiments were laid out simultaneously under Randomized block design with three replications. The gross and net plot sizes were 4.8 × 4 m and 3.6 × 3.6 m respectively. Tubers were planted at the spacing of 60 × 20 cm. In the first experiment different organic manures such as Jaivik, neem cake, karanze cake, castor cake and mustard cake were applied in the field at the rate of 5 q/ha in addition to recommended dose of NPK and were studied in relation to the tuber yield and formation of scurfed tuber. Check plots with only recommended dose of NPK were also planted. In the second experiment,

the crop was irrigated at the interval of 10, 20, 30 and 40 days alongwith rainfed (without irrigation) in relation to tuber yield and development of scurfed potato. In the third experiments, different cropping sequences such as potato after urd bean, potato after rice, potato after maize, potato after potato, potato after kharif onion and potato after cauliflower were studied. A susceptible variety, Ashoka, was planted in all the cases. The data on disease intensity was recorded as per 0 to 4 rating scale in all the experiments. Tuber yield was recorded at the harvesting time.

RESULTS AND DISCUSSION

Effect of Organic manures

The result (Table 1) shows that all the organic manures were positively correlated (r = + 0.7) with the tuber yield and negatively (r = –0.6) with the disease development. In case of tuber yield all the organic manure exhibited almost similar response indicating non-significant importance among themselves, but use of only recommended dose of N : P : K proved significantly inferior to other treatments, indicating statistically similar result regarding reduction of disease incidence and intensity. These treatments were followed by mustard cake, castor cake and Jaivik. Use of only recommended dose of NPK showed maximum incidence 14 per cent and intensity 1.7. The positive correlation (r = + 0.7) between tuber yield and organic manure might be due to supplementation of different macro and micro nutrients in the soil to sustain productivity and to maintain good health of the soil including water holding capacity. These factors were also responsible in the reduction of scurfed tubers in these treatments. However, variation in incidence and intensity among different organic manures might be due to presence of same inhibitory substance in some manures like neem and karanze cakes. These pattern of findings and probable reasons are in consonance of finding of Alexander (1978) and Papavizas (1963).

Table 1 : Effect of organic manure on the tuber yield and scurfed potato

Treatment	Tuber yield (q/ha)	Disease development	
		incidence (%)	Intensity (0-4)
Jaivic	268.0	9.0	1.5
Neem cake	270.0	4.0	1.0
Karanze cake	267.0	3.5	1.0
Castor cake	266.0	7.5	1.4
Mustard cake	265.0	6.0	1.3
Only NPK R.D.	253.0	14.0	1.7
CD at 5%	5.0	2.2	0.2

Effect of irrigation intervals

It is clear from the data presented in Table 2 that the highest tuber yield (252 q/ha) was recorded when the crop was irrigated at 30 days interval. Plot irrigated at 20 and 40 days indicated statistically similar tuber yield. Drastic reduction in tuber yield 145 q/ha was recorded when plot was irrigated at the interval of only 10 days. However the minimum tuber yield (122 q/ha) was recorded in case of the crop grown as rainfed. This might be due to the fact that soil aeration and temperature were reduced while carbon dioxide concentration was increased in soil having high soil moisture content. Regarding the development of scurfed tubers, very strong positive correlation (r – = + 0.8) was observed between reduction in irrigation interval and development of scurfed tuber, indicating the maximum disease incidence (34%) and intensity (2.4) from the field where irrigation was applied at the interval of 10 days. Both incidence and intensity of the disease declined when the irrigation interval was increased. Rainfed crop indicated minimum disease incidence (4%) and intensity (1.2). This might be because of rapid multiplication of the pathogen (*R. solani*) under heavy moisture condition, resulting heavy inoculum density in the soil for rapid development of scurfed tubers. All these findings and possible reasons for variation in disease intensity and tuber yield are in accordance with the findings of Kannaiyan *et al.* (1981) and Jha and Kang (1988).

Table 2 : Effect of irrigation interval on the tuber yield and scurfed potato

Treatment	Tuber yield (q/ha)	Disease development incidence (%)	Intensity (0-4)
10 days	145.0	34.0	2.4
20 days	225.0	22.0	1.9
30 days	252.0	10.0	1.5
40 days	217.0	6.0	1.3
Rainfed	122.0	4.0	1.2
CD at 5%	9.0	3.0	0.2

Effect of different cropping sequence

Six cropping sequences were studied in relation in to the tuber yield as well as development of scurfed tuber and the data are presented in Table 3. It is clear from the data that potato grown after urd bean indicated highest tuber yield of 265 q/ha. It was followed by potato grown after kharif onion and potato after cauliflower. The least yield of 236 q/ha was obtained when potato was grown after maize and statistically similar yield was recorded with potato was grown after rice. The data also indicated that the minimum disease incidence, 5 per cent, and intensity, 1.0, were recorded where potato was grown after Kharif onion. Statistically similar disease response was recorded where potato was grown after urd bean. However, potato grown after rice indicated the maximum incidence of scurfed tuber (15%) and was closely followed by potato grown after potato (14%) and potato grown after maize (13%). Data related to the intensity of scurfed tubers, maximum intensity 2.2 was recorded when potato was grown after potato which was followed by potato grown after rice (1.8) and potato grown after maize (1.7). Better response of urd bean might be due to the production of rhizobium nodules in the root of urd bean associated with bacterium responsible for fix atmospheric nitrogen in the plant which cared the soil fertility and health. Besides, maize is not only heavy feeder but also prone to *Rhizoctonia solani*. These factors might be responsible for losses in tuber yield and compounding more scurfed tubers. The cause of increase in disease severity in case of potato after rice and potato after potato is due to increase in inoculum potential in both cases as *R. solani* gets a congenial environment in the same field. These results are in confirmity with those of Botros and Mohamed (1990) and Kumar (1999).

Table 3 : Effect of different cropping sepeence on the tuber yield and scurfed potato

Treatment	Tuber yield (q/ha)	Disease development incidence (%)	Intensity (0.4)
Potato after urd been	263	7	1.0
Potato after rice	240	15	1.8
Potato after maize	236	13	1.7
Potato after potato	256	14	2.2
Potato after *Kharif* onion	258	5	1.0
Potato after cauliflower	257	10	1.4
CD at 5%	4	2	0.2

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(Accepted for publication October 10, 2004)