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Research Paper

# Screening of some potato germplasms against plant and tuber damage caused by soil pests

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**Abstract:** The present field experiment was undertaken to work out the role of different potato germplasms against plant and tuber damage caused by soil pests, viz. cutworm, *Agrotis ipsilon* (Hufn.) (Noctuidae: Lepidoptera) and mole cricket, *Gryllotalpa africana* P.de Beau. (Gryllotalpidae: Orthoptera) during rabi season from November to March in 2013-2014 and 2014-2015, respectively at Adisaptagram Block Seed Farm, Hooghly, West Bengal. The plant emergence was varied from 81.33-95.33% irrespective of different potato germplasms. The per cent plant damage caused by cutworm and mole cricket together was also varied from one germplam to another. Maximum percentage of plant damage was recorded during early stages of crop-growth than later stage. The per cent plant (shoot) damage was found higher in K. Badshah, K. Chipsona-2, K. Jawahar, K. Sutlez and K. Sailaja while it was lower in K. Anand, K. Ashoka and K. Chipsona-1. Moderate to high percentage of plant damage was observed in K. Chandramukhi, K. Jyoti and K. Pukhraj, K. Anand, K. Badshah, K. Ashoka, K. Chipsona-2 and K. Sailaja showed greater percentage of cutworm damage and these germplasms are moderate to highly susceptible to the pest. K. Chipsona-1, K. Jyoti, K. Pukhraj were less susceptible or tolerant and K. Chandramukhi, K. Jawahar and K. Sutlej were moderately susceptible to the pest. Maximum mole cricket damage was found in K. Chipsona-2, K. Sutlez and K. Sailaja. Per cent yield of healthy tubers of potato was noted maximum in K. Jawahar while it was minimum in K. Chipsona-2. Total tuber yield (t/ha) of potato was recorded highest in K. Badshah (36.58- 43.92) while it was lowest in K. Pukhraj (22.08-22.12).
**Keywords:** Potato, germplasms, soil pest, damage, plant, tuber, screening.

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## INTRODUCTION:

Potato, *Solanum tuberosum* L. is generally grown in almost all the states and under very diverse conditions. Among the states, Uttar Pradesh and Bihar accounted for nearly 71% area and 76% production of the country (Chadha, 2002). In West Bengal potato is the most important food crop, next to cereals and the states ranks second position in area and production, but first in productivity in the country (Rai, 2003). Earlier potato cultivation was largely confined to the district of Hooghly, Burdwan and West Midnapore but with the increasing facilities of irrigation, introduction of high yielding early maturing varieties and development of suitable agronomic practices, potato cultivation is gradually being extended to other districts (Anonymous, 2005). Potato is vulnerable to attack of pest both in the field as well as in godowns. Simpson (1977) reported more than 100 arthropods in potato crop in various parts of the world. Butani and Verma (1976); Misra and Agrawal (1988) gave a comprehensive list of insect and non-insect pests damaging potato crop in context of India. Among these soil pests of potato like cutworm, *Agrotis ipsilon* (Hufn.) (Noctuidae: Lepidoptera) and mole cricket, Gryllotalpa Africana P.de Beau (Gryllotalpidae: Orthoptera) were mainly responsible for causing tuber damage, resulting in reduced yield of the crop. They also caused damage to the foliage of the crop. They cut the tender shoots near the ground level and ate the leaves. To minimize the crop loss by the soil pests, the grower use pesticide not only as control tactics, but as an assurance against uncertain pest attacks. As a result, the chances of health hazards are increased as in many cases potato is used just after little boiling. Therefore a field investigation was carried out to evaluate the effectiveness of different potato germplasms against plant damage as well as tuber damage caused by soil pests, viz. cutworm and mole cricket which is one of the ecofriendly control method against the pests.

## MATERIALS AND METHODS:

The present field experiment was undertaken to assess the effectiveness of different potato germplasms against plant and tuber damage, caused by soil pests, namely cutworm and mole cricket during rabi season from November to March of 2013-2014 and 2014-15 at Adisaptagram Block Seed Farm, Hooghly, West Bengal. The Block Seed Farm is situated at 22.570 N latitude 88.200 E longitudes and 7.8 m altitude above mean sea level. The experiment was carried out in randomized block design (RBD) with eleven potato germplasms, namely, Kufri Anand, K. Ashoka, K. Badshah, K. Chandramukhi, K. Chipsona-1, K. Chipsona-2, K. Jawahar, K. Jyoti, K. Pukhraj, K. Sutlez and K. Sailaja, each replicating for thrice. Plot size was kept at 6m x 2m with 60 cm inter-row and 20cm intra row spacing. The crop was sown during end November in the year. All standard agronomic practices in the state were strictly followed for growing the crop, except application of any pesticides. Irrespective of the germplasms the crop was dehaulmed at an age of 85 days i.e, during first week of March and finally ten days after haulm cutting the crop was harvested. The total number of plant damaged by soil pests (cutworm and mole cricket) was recorded at 7 days interval in each plot and the per cent plant damage was worked out accordingly. Similarly, the extent of infestation in tuber by different soil pests was recorded by counting the number of healthy and damaged tubers for each treatment were also taken and thereafter, the data were analyzed after converting them into necessary forms.

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## RESULTS AND DISCUSSION:

**Plant damage caused by soil pests on different germplasms:** In the first year of study during 2013-2014, the plant emergence was found maximum in K. Ashoka (95.33%) and minimum in K. Chipsona-2 (83.33%) (Table 1).

**Table 1: Per cent plant damage caused by soil pests (cutworm and mole cricket together) on dofferent potato germplasms during 2013-14 and 2014-15 at Adisaptagram Block Seed Farm, Hooghly, West Bengal. (Mean at three replication)**

| Different potato germplasms | Percent plant emergence | | Total number of shoots (per plot) | | | | Per cent plant (Shoot) damage | |
|---|---|---|---|---|---|---|---|---|
| | | | Healthy | | Damaged | | | |
| | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 |
| **1.** K. Anand | 92.66 (1.96) | 95.33 (1.98) | 439.66 (2.64) | 433.66 (2.63) | 38.33 (1.59) | 32.66 (1.51) | 8.01 (0.95) | 6.95 (0.89) |
| **2.** K. Ashoka | 95.33 (1.98) | 93.66 (1.97) | 457.33 (2.65) | 451.33 (2.65) | 42.33 (1.63) | 39.66 (1.60) | 8.47 (0.97) | 8.05 (0.95) |
| **3.** K. Badshah | 94.66 (1.97) | 91.66 (1.96) | 446.00 (2.64) | 438.66 (2.63) | 65.33 (1.82) | 57.00 (1.76) | 12.80 (1.14) | 11.50 (1.09) |
| **4.** K. Chandramukhi | 90.66 (1.96) | 94.33 (1.97) | 422.33 (2.62) | 443.33 (2.64) | 44.00 (1.65) | 41.33 (1.62) | 9.42 (1.01) | 8.53 (0.97) |
| **5.** K. Chipsona-1 | 89.33 (1.94) | 88.66 (1.95) | 429.66 (2.63) | 406.33 (2.60) | 37.66 (1.58) | 30.66 (1.49) | 8.05 (0.95) | 6.99 (0.90) |
| **6.** K. Chipsona-2 | 83.33 (1.92) | 82.33 (1.91) | 395.33 (2.71) | 381.33 (2.57) | 40.66 (1.61) | 38.66 (1.59) | 9.32 (1.01) | 9.16 (1.00) |
| **7.** K. Jawahar | 91.00 (1.96) | 90.66 (1.96) | 417.33 (2.62) | 428.66 (2.62) | 54.33 (1.74) | 49.33 (1.69) | 11.52 (1.09) | 10.32 (1.05) |
| **8.** K. Jyoti | 92.33 (1.97) | 89.33 (1.95) | 434.66 (2.63) | 402.33 (2.60) | 43.66 (1.64) | 34.33 (1.54) | 9.10 (1.00) | 7.86 (0.94) |
| **9.** K. Pukhraj | 88.33 (1.91) | 81.33 (1.91) | 408.66 (2.62) | 397.66 (2.59) | 40.66 (1.61) | 38.66 (1.59) | 8.83 (0.99) | 8.97 (0.99) |
| **10.** K.Sutlez | 88.66 (1.91) | 90.00 (1.95) | 423.33 (2.62) | 434.33 (2.63) | 46.30 (1.67) | 40.66 (1.61) | 9.85 (1.09) | 8.56 (0.98) |
| **11.** K. Sailaja | 92.33 (1.96) | 94.33 (1.97) | 422.66 (2.62) | 451.33 (2.62) | 55.66 (1.75) | 47.66 (1.68) | 11.64 (1.09) | 9.53 (1.02) |
| SEM ± | 0.01 | 0.007 | 0.04 | 0.005 | 0.03 | 0.12 | 0.01 | 0.01 |
| C.D.- 0.05 | 0.04 | 0.018 | 0.10 | 0.013 | 0.06 | 0.028 | 0.03 | 0.03 |

The number of healthy shoots per plot was ranged from 395.33 in K. Chipsona-2 to 457.33 in K. Ashoka. Similarly the number of damaged shoots in each plot was highest in K. Badshah (65.33) and lowest in K. Chipsona-1 (37.66). K. Badshah also registered maximum percentage of plant damage (%) (12.80), which was trailed by K. Sailaja (11.64), K. Jawahar (11.52), K. Sutlez (9.85), K. Chandramukhi (9.42), K. Chipsona-2 (9.32), K. Jyoti (9.10), K. Pukhraj (8.83), K. Ashoka (8.47),

K.Chipsona-1 (8.05), K. Anand (8.01) respectively and these were significantly different from each other.

In the second year of study during 2014-15, the plant emergence was found highest in K. Anand (95.33%) and lowest in K. Pukhraj (81.33%) (Table-1). Total number of healthy shoots per plot was recorded highest (451.33) both in K. Ashoka and K. Sailaja and lowest in K. Chipsona-2 (381.33). The number of damaged shoots in each plot was maximum in K. Badshah (57.00) and minimum in K. Chipsona-1 (30.66). Similarly K. Badshah also recorded highest percentage (%) of plant (shoot) damage (11.50) and then in order were K. Jawahar (10.32), K. Sailaja (9.53), K. Chipsona-2 (9.16), K. Pukhraj (8.97), K. Sutlez (8.56), K. Chandramukhi (8.52), K. Ashoka (8.05), K. Jyoti (7.86), K. Chipsona-1 (6.99) and K. Anand (6.95), respectively.

From the results of two consecutive seasons it can be concluded that the plant emergence was varied from 81.33 to 95.33% irresepective of different potato germplams. The per cent plant (shoot) damage was found maximum in K. Badshah (10.29-12.80) which was followed by K. Chipsona-2 (9.32-10.16), K. Jawahar (9.92-11.52), K. Sutlez (8.56-9.85), K. Sailaja (9.53-11.64), K. Ashoka (7.44-8.47), K. Chipsona-1 (6.99-8.05) and K. Anand (6.95-8.19) irrespectively. Thus, K. Badshah, K. Anand, K. Ashoka and K. Sailaja are highly susceptible; K. Chandramukhi, K. Jawahar, K. Sutlez and K. Chipsona-2 were moderately susceptible and K. Chipsona-1, K.Jyoti and K. Pukhraj were less susceptible or tolerant to the pests. These findings are in agreement with those reported earlier by Ram *et al*. (2001), who obtained moderate to high percentage of plant damage in K. Badshah, K. Chandramukhi and K. Jyoti than Rajendra-1, K Sindhuriows.

**Tuber damage caused by soil pests and yield of different potato germplasms:** In the first year of study 2013-2014, the number and weight of healthy tubers were varied from 524.33 per plot in Kufri Jyoti to 694.33 in K. Anand and 17.55 kg/plot in K. Pukhraj to 31.70 kg/plot in K. Badshah, respectively (Table-2).

**Table 2: Yield of different potato germplasms during 2013-14 at Adisaptagram Block Seed Farm, Hooghly, West Bengal. (Mean of three replications)**

| Different potato germplasms | Healthy Tubers (kg/plot) | Damaged tubers (kg/plot) | | | | | Per cent (%) yield | | Total Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | Cutworm | Mole cricket | PTM | Rat | Total | Healthy tubers | Damaged tubers | |
| 1. K. Anand | 29.50 | 7.10 | 2.60 | 0.00 | 1.90 | 11.60 | 75.40 | 24.60 | 34.25 |
| 2. K. Ashoka | 27.90 | 9.45 | 3.30 | 0.00 | 2.80 | 15.55 | 69.67 | 30.33 | 36.21 |
| 3. K. Badshah | 31.70 | 8.40 | 2.20 | 0.30 | 1.30 | 12.20 | 77.76 | 22.44 | 36.58 |
| 4. K. Chandramukhi | 22.85 | 5.15 | 2.00 | 0.00 | 1.75 | 8.90 | 73.19 | 26.81 | 26.46 |
| 5. K. Chipsona-1 | 19.70 | 4.00 | 1.90 | 0.00 | 1.00 | 6.90 | 73.64 | 26.36 | 22.17 |
| 6. K. Chipsona-2 | 18.65 | 8.10 | 3.45 | 0.70 | 1.40 | 13.65 | 64.71 | 35.29 | 26.92 |
| 7. K. Jawahar | 23.70 | 5.50 | 2.65 | 0.00 | 1.60 | 9.75 | 75.97 | 24.03 | 27.87 |
| 8. K. Jyoti | 23.70 | 4.50 | 2.60 | 0.60 | 0.80 | 8.50 | 73.04 | 26.96 | 26.50 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 9. K. Pukhraj | 17.55 | 5.20 | 1.80 | 0.40 | 1.60 | 9.00 | 69.38 | 30.62 | 22.12 |
| 10. K.Sutlez | 20.70 | 6.30 | 2.25 | 0.20 | 1.50 | 10.25 | 73.16 | 26.84 | 25.79 |
| 11. K. Sailaja | 27.30 | 7.85 | 3.40 | 0.00 | 1.35 | 12.60 | 72.04 | 27.91 | 33.25 |
| SEM ± | 2.16 | 0.28 | 0.27 | 0.10 | 0.22 | 1.09 | - | - | - |
| C.D.- 0.05 | 5.22 | 0.67 | 0.66 | 0.23 | 0.53 | 2.62 | - | - | - |

The cutworm damage per plot was found maximum in K. Chipsona-2 (119.00) on number basis while it was minimum in K. Jyoti (40.66). But on weight basis, K. Ashoka recorded highest cutworm damage per plot (9.45kg) which was succeded by K. Badshah (8.40kg), K. Chipsona-2 (8.10kg), K. Sailaja (7.85kg), K. Anand (7.10kg), K. Sutlez (6.30kg), K. Jawahar (5.50kg), K. Pukhraj (5.20kg), K. Chandramukhi (5.15kg), K. Jyoti (4.50kg) and K. Chipsona-1 (4.00kg), respectively. Regarding the mole cricket damage per plot, K. Sailaja suffered most (38.00) followed by K. Chipsona-2 (35.66), K. Chipsona-1 (32.33), K. Ashoka (31.33), K. Anand (29.00), K. Pukhraj (27.66), K. Jawahar (27.33), K. Jyoti (24.33), K. Sutlez (24.0), K. Chandramukhi (18.00) and K. Badshah (16.66), respectively on number basis. But on weight basis, K. Chipsona-2 ranked first (3.45kg/plot) and then K. Sailaja (3.40), K. Ashoka (3.30), K. Jawahar (2.65), K. Anand (2.60), K. Jyoti (2.60), K. Sutlez (2.25), K. Badshah (2.20), K. Chandramukhi (2.00), K. Chipsona-1 (1.90) and K. Pukhraj (1.80) respectively. PTM (Potato tuber moth) damage on potato tuber was found to vary from 2.66-9.33 per plot on number basis and 0.20-0.70 kg/plot on weight basis. It was only observed in K. Badshah, K. Chipsona-2, K. Jyoti, K. Pukhraj and K. Sutlez. The rat damage on number basis was ranged from 11.66 per plot in K. Sailaja to 27.00 per plot in K. Ashoka, while on weight basis, K. Ashoka recorded highest rat damage (2.80kg/plot) while it was lowest in K. Jyoti (0.80kg/plot). The total tuber damage caused by different soil pests, it was seen that K. Chipsona-2 was most affected by the pests on number basis (183.66 per plot) and K. Jyoti was least affected (86.33), while the total damage on weight basis was found maximum in K. Ashoka (15.55kg/plot) and minimum in K. Chipsona-1 (6.90kg/plot). But regarding per cent damaged tubers on weight basis, K. Chipsona-2 stand first (42.26), followed by K. Ashoka (35.79), K. Pukhraj (33.9.), K. Sutlez (33.12), K. Sailaja (31.58), K. Jawahar (29.15), K. Anand (28.22), K. Chandramukhi (28.03), K. Badshah (27.79), K Jyoti (26.73) and K. Chipsona-1 (25.94), respectively and the reverse picture was found when the per cent healthy tubers of potato (weight basis) was concerned (Table 2). The total tuber yield (t/ha) was observed highest in K. Badshah (36.58) which was closely followed by K. Ashoka (36.21) and then K. Anand (34.25), K. Sailaja (33.25), K. Jawahar (27.87), K. Chipsona-2 (26.92), K. Jyoti (26.50), K. Chipsona-1 (22.17) and K. Pukhraj (22.12), respectively.

In the second year of study during 2014-15, K. Anand obtained the best yield of healthy potato tubers (Table-3) on number basis (768.33 per plot) and it was least in K. Pukhraj (51.66 per plot).

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**Table 3: Yield of different potato germplasms during 2014-15 at Adisaptagram Block Seed Farm, Hooghly, West Bengal. (Mean of three replications)**

| Different potato germplasms | Healthy Tubers (kg/plot) | Damaged tubers (kg/plot) | | | | | Per cent (%) yield | | Total Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|
| | | Cutworm | Mole cricket | PTM | Rat | Total | Healthy tubers | Damaged tubers | |
| 1. K. Anand | 36.20 | 7.00 | 2.10 | 0.00 | 3.00 | 12.10 | 74.95 | 25.05 | 40.25 |
| 2. K. Ashoka | 33.60 | 8.80 | 1.65 | 0.00 | 3.75 | 14.20 | 70.29 | 29.71 | 39.83 |
| 3. K. Badshah | 40.00 | 7.60 | 2.00 | 0.90 | 2.20 | 12.70 | 75.90 | 24.10 | 43.92 |
| 4. K. Chandramukhi | 23.55 | 5.25 | 2.05 | 0.00 | 2.00 | 9.30 | 71.69 | 28.31 | 27.37 |
| 5. K. Chipsona-1 | 26.30 | 5.20 | 2.15 | 0.70 | 1.20 | 9.30 | 73.88 | 26.12 | 29.67 |
| 6. K. Chipsona-2 | 23.75 | 6.60 | 2.55 | 1.00 | 2.10 | 12.25 | 65.97 | 34.03 | 30.00 |
| 7. K. Jawahar | 34.20 | 6.25 | 2.10 | 0.60 | 1.90 | 10.85 | 75.91 | 24.09 | 37.54 |
| 8. K. Jyoti | 27.85 | 4.90 | 2.10 | 0.00 | 2.00 | 9.00 | 75.58 | 24.42 | 30.71 |
| 9. K. Pukhraj | 18.40 | 4.50 | 1.70 | 0.00 | 1.90 | 8.10 | 69.43 | 30.57 | 22.08 |
| 10. K.Sutlez | 26.95 | 6.80 | 2.90 | 0.40 | 1.55 | 11.65 | 69.82 | 30.18 | 32.17 |
| 11. K. Sailaja | 32.80 | 7.30 | 3.60 | 0.00 | 2.15 | 13.05 | 71.00 | 29.00 | 38.50 |
| SEM ± | 0.89 | 0.12 | 0.08 | 0.09 | 0.10 | 0.14 | - | - | - |
| C.D.- 0.05 | 2.15 | 0.29 | 0.19 | 0.21 | 0.23 | 0.35 | - | - | - |

But on weight basis maximum yield of healthy per plot was obtained in K. Badshah (40.00kg) while it was minimum in K. Pukhraj (18.40kg). Cutworm was the most important pest, which caused a considerable tuber damage ranging from 38.33-97.66 per plot on number basis and from 3.80- 8.80 kg/plot on weight basis and from 3.80-8.80 kg/plot on weight basis. The cutworm damage was found maximum in K. Ashoka (8.80kg/plot) while it was minimum in K. Pukhraj (4.50kg/plot). Similarly the mole cricket was recorded highest in K. Sailaja (3.60kg/plot) while it was lowest in K. Ashoka (1.65kg/plot) PTM damage on potato tuber was observed only in K. Badshah, K. Chipsona-1, K. Chipsona-2, K. Jawahar and K. Sutlez and damage on weight basis, was ranged from 1.0kg/plot in K. Chipsona-1 to 0.40kg/plot in K. Sutlez. The rat damage was observed highest in K. Ashoka (3.75kg/plot) on weight basis and lowest in K. Chipsona-1 (1.20kg/plot). Finally, irrespective of different pests, on weight basis, the maximum damage (kg/plot) was noted in K. Ashoka (14.20) and then in the order were K. Sailaja (13.40), K. Badshah (12.70), K. Chipsona-2 (12.25), K. Anand (12.10), K. Sutlez (11.65), K. Jawahar (10.85), K. Chandramukhi (9.30), K. Chipsona-1 (9.30), K. Jyoti (9.00) and K. Pukhraj (8.10), respectively. But, when per cent healthy tuber yield (%) of potato ( on weight basis)

was considered K. Jawahar came first (75.91) which was followed by K. Badshah (75.90), K. Jyoti (75.58), K. Anand (74.95), K. Chipsona-1 (73.88), K. Chandramukhi (71.69), K. Sailaja (71.00), K. Ashoka (70.29), K. Sutlez (69.82), K. Pukhraj (69.43) and K. Chipsona-2 (65.97), respectively (Table-3). The highest total tuber yield (t/ha) was obtained from K. Badshah (43.92) and lowest from K. Pukhraj (22.08).

Therefore, it can be concluded from the present field trial that there was a significant yield differences in different potato germplasm. Among the soil pests, cutworm played the most important role in reducing the remarkable yield of the crop in all the germplasms, followed by mole cricket. Maximum tuber damage by the noctuid was recorded in K. Ashoka, while it was minimum in K. Pukhraj, K. Anand, K. Badshah, K. Chipsona-2 and K. Sailaja, showed greater percentage of cutworm damage and this germplasms are said to be highly susceptible, K. Chandramukhi, K. Ashoka, K. Sutlez and K. Jawahar were moderately susceptible and K. Chipsona-1, K. Jyoti and K. Pukhraj were less susceptible or tolerant to the pest Ram *et al.* (2001) also observed that K. Badshah was more susceptible to the pest than K. Jyoti. K. Chipsona-2, K. Sutlez and K. Sailaja recorded maximum damage caused by mole cricket. PTM damage on tubers was found in K. Anand, K. Ashoka and K. Sailaja during present study while it was found only in K. Chipsona-2 in both year of study. Rat damage was significantly variable from one germplasm to another, but in most of the cases, these were at par with other. Maximum percent of healthy tubers on weight basis was recorded in K. Badshah (upto 77.56%) while it was minimum in K. Chipsona-2 (upto 69.97%). The total tuber yield (t/ha) was obtained highest in K. Badshah (36.58-43.92), while it was lowest in K. Pukhraj (22.08-22.12). The total tuber yield of different potato germplasms was quite higher during second year than the previous year. It may be due to the fact that in this year (2014-15), during tuber formation stage of the crops, the mean temperature was around $20^0$ C, which helped to increase the tuber production as under this condition, Murti and Banerjee (1976) obtained maximum yield of potato tubers. These results are also more or less corroborated with the findings of Singh and Sharma (2001), Patel *et al*. (2002), Lakra (2003) and Abbasi *et al.* (2004).

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