

## REACTION OF GRASSPEA GERMPLASM RESISTANT TO RUST AND POWDERY MILDEW DISEASES

M. SHAHIDUZZAMAN<sup>1</sup>, S. R. MALLICK<sup>2</sup> AND A. K. DAS<sup>3</sup>

Keywords: Grasspea, germplasm, rust and powdery mildew.

Grasspea (*Lathyrus sativas L.*) is popular as fodder crop as well as highest protein containing pulse in Bangladesh. It has a high potential compared to other grain legumes both as food and fodder crops, due to their high nutritional value and aptitude to withstand drought and excessive soil moisture, salinity and low soil fertility (Hanbury *et al.*, 2000). It is also the hardiest crop among the pulses and can survive where extreme environmental conditions prevail (Palmer *et al.*, 1989). It improves the fertility status of soil through atmospheric nitrogen fixation and can fix approximate 40-46 kg N/ha/yr (Brahmaprakash *et al.*, 2004). It occupies the first position in area and production, it contributes about one third of the total pulses in Bangladesh (Krishi Diary, 2017). Though grasspea can survive under different adverse conditions, disease like rust and powdery mildew can affect badly on yield in field.

In an agricultural setting, the pathogen can be controlled using chemical methods, genetic resistance, and careful farming methods. Among them resistance is the cheapest and environmentally safe method. So, the study was performed to search for resistant germplasm against rust and powdery mildew among the genotypes of grasspea having higher yield potential.

The experiment was conducted at Regional Pulses Research Station (RPRS), BARI, Madaripur during *rabi* season of 2013-14 under natural condition. Seventy five entries of grasspea including a check BARI Kheshari-3 were collected from Pulses Research Center, BARI, Ishwardi, Pabna were included in the trial. The experiment was laid out in Randomized Complete Block Design (RCBD) and the plot size was 8m x 3m per ten entries and each entry was in two rows with the spacing 40cm from row to row with two replications. Seeds were sown on 18 November 2013. All recommended fertilizers were applied as basal dose during final land preparation. Intercultural operations were done as per requirement. Powdery mildew of grasspea was recorded on a 0-5 scoring scale (Bhatia and Thakur, 1989). The scale described as 0= no disease incidence and 5= above 50% leaf area covered by powdery mildew disease. Rust of grasspea was graded on a 1-9 scoring scale as modified by Morall and McKenzie (1974). The scale described as 1= no pustules visible, 3= few scattered pustules, usually

---

<sup>1&2</sup>Scientific Officer, Regional Pulses Research Station, Bangladesh Agricultural Research Institute (BARI), Madaripur, <sup>3</sup>Scientific Officer, Regional Agricultural Research Station, Rahmatpur, Barisal. Bangladesh.

seen after careful searching, 5= pustules common on leaves and easily observed, but causing no apparent damage, 7= pustules very common and damaging but no pustules on petioles and stems, 9= pustules extensive on leaves, petioles and stems, causing death of leaves and other plant parts. The crop was harvested after maturity. Data on yield contributing characters were recorded from 10 randomly selected plants from each plot. Grain yield (kg/ha) were recorded from the two rows. Mean comparisons for treatment parameters were made by LSD at 5% level of significance.

The tested grasspea genotypes/variety showed substantial variation in disease reaction for both rust and powdery mildew. Rust score among the test entries/varieties ranged from 3-7. None of the genotypes could exhibit complete resistance or immune to rust. Among 75 lines, 27 were graded as resistant which bear the score 3, 32 including check variety BARI Kheshari-3 graded as moderately resistant which took the score 5 and rest 16 lines graded as susceptible which bear the score 7 (Table 1).

**Table 1. Distribution of grasspea lines in various infection categories of rust at RPRS, Madaripur during 2013-14.**

| Infection category   | Grade | No. of genotypes | Lines involved  |
|----------------------|-------|------------------|---|
| Highly resistant     | 1     | -                | -   |
| Resistant            | 3     | 27               | BGP-3, BGP-5, BGP-7, BGP-11, BGP-46, BGP-48, BGP-53, BGP-58, BGP-64, BGP-66, BGP-80, BGP-95, BGP-101, BGP-108, BGP-121, BGP-128, BGP-159, BGP-189, BGP-190, BGP-198, BGP-199, BGP-202, BGP-204, BGP-205, BGP-206, BGP-230 and BGP-255   |
| Moderately resistant | 5     | 32               | BGP-4, BGP-6, BGP-9, BGP-13, BGP-14, BGP-15, BGP-19, BGP-51, BGP-54, BGP-71, BGP-78, BGP-88, BGP-98, BGP-105, BGP-115, BGP-122, BGP-131, BGP-136, BGP-156, BGP-157, BGP-158, BGP-169, BGP-170, BGP-186, BGP-188, BGP-209, BGP-216, BGP-218, BGP-220, BGP-221, BGP-222 and BARI Kheshari-3 |
| Susceptible          | 7     | 16               | BGP-21, BGP-24, BGP-25, BGP-31, BGP-40, BGP-43, BGP-140, BGP-142, BGP-143, BGP-148, BGP-150, BGP-225, BGP-226, BGP-227, BGP-233 and BGP-244   |
| Highly susceptible   | 9     | -                | -   |

Powdery mildew score among the test entries ranged from 0-5. Among 75 lines, 38 were graded as resistant which bear the score 0, 37 graded as susceptible which took the score 5 (Table 2).

**Table 2. Distribution of grasspea lines in various infection categories of powdery mildew at RPRS, Madaripur during 2013-14.**

| Infection category | Grade | No. of genotypes | Lines involved   |
|--------------------|-------|------------------|--|
| Resistant          | 0     | 38               | BGP-3, BGP-4, BGP-5, BGP-6, BGP-7, BGP-9, BGP-11, BGP-13, BGP-14, BGP-15, BGP-19, BGP-21, BGP-24, BGP-25, BGP-46, BGP-64, BGP-80, BGP-105, BGP-108, BGP-115, BGP-121, BGP-122, BGP-128, BGP-131, BGP-136, BGP-140, BGP-142, BGP-143, BGP-148, BGP-150, BGP-156, BGP-157, BGP-158, BGP-159, BGP-169, BGP-230, BGP-255 and BARI Kheshari-3 |
| Susceptible        | 5     | 37               | BGP-31, BGP-40, BGP-43, BGP-48, BGP-51, BGP-53, BGP-54, BGP-58, BGP-66, BGP-71, BGP-78, BGP-88, BGP-95, BGP-98, BGP-101, BGP-170, BGP-186, BGP-188, BGP-189, BGP-190, BGP-198, BGP-199, BGP-202, BGP-204, BGP-205, BGP-206, BGP-209, BGP-216, BGP-218, BGP-220, BGP-221, BGP-222, BGP-225, BGP-226, BGP-227, BGP-233 and BGP-244         |

Results showed that there were significant differences among the entries of grasspea in yield and contributing characters (Table 3). Days to flowering of grasspea entries were varied from 66-92. The maximum days to flowering (92) observed in BGP-140 and minimum (66) in BGP-43. The ranges in days to maturity were varied from 112-130. The maximum days to harvest (130) were recorded in BGP-140 and minimum (112) was in BGP-43, BGP-218. The plant height ranged from 37.80-99.50 cm. The highest plant height was recorded in BGP-128 (99.50 cm) which was significantly different over other germplasm and lowest in BGP-15 (37.80 cm). Number of branches/plant was varied from 2.70-5.00. The maximum number of branches/plant (5.00) was found in BGP-157 and minimum (2.70) in BGP-226. The number of pods/plant varied from 6.70 to 53.70. The maximum number/pods per plant (53.70) obtained from BGP-64 followed by (48.50) in BGP-108 and minimum (6.70) in BGP-227. The number of seeds/pod varied from 1.70 to 5.20. The maximum number of seeds/pod (5.20) obtained from BGP-115 and minimum (1.70) in BGP-13. 100 seeds weight varied from 5.00 to 16.00 g. The maximum 100 seeds weight (16 g) obtained from BGP-66 and minimum (5.00 g) from BGP-140, BGP-202, BGP-204, BGP-209, BGP-218 and BGP-226. The highest yield (1560 kg/ha) obtain from BGP-108 and lowest (120 kg/ha) from BGP-15. Among the genotypes, 8 lines viz. BGP-46 (1250 kg/ha), BGP-64 (1530 kg/ha), BGP-80 (1220 kg/ha), BGP-108 (1560 kg/ha), BGP-121(1130), BGP-128(1430), BGP-230 (1310 kg/ha) and BGP-255 (1320 kg/ha) yielded better than the check BARI Kheshari-3 (1020 kg/ha). All these eight lines showed resistant reaction to rust and powdery mildew.

Table 3. Yield and yield contributing characters of grasspea genotypes at Madaripur during Rabi season of 2013-14.

| Entries | Days to flower | Days to harvest | Plant height (cm) | No. of branch / plant | No. of pods/ plant | No. of seed / pod | 100 seeds wt (g) | Rust score (1-9 scale) | Powdery Mildew score (0-5 scale) | Yield (kg/ha) |
|---------|----------------|-----------------|-------------------|-----------------------|--------------------|-------------------|------------------|------------------------|----------------------------------|---------------|
| BGP-3   | 79             | 123             | 59.70             | 3.10                  | 22.00              | 2.50              | 6.50             | 3.00                   | 0.00                             | 370           |
| BGP-4   | 88             | 126             | 48.30             | 4.30                  | 13.90              | 3.10              | 11.00            | 5.00                   | 0.00                             | 270           |
| BGP-5   | 78             | 121             | 59.00             | 3.50                  | 17.60              | 4.10              | 6.50             | 3.00                   | 0.00                             | 130           |
| BGP-6   | 69             | 119             | 58.10             | 3.90                  | 12.90              | 3.30              | 6.00             | 5.00                   | 0.00                             | 631           |
| BGP-7   | 75             | 126             | 85.10             | 3.30                  | 40.70              | 3.00              | 7.00             | 3.00                   | 0.00                             | 1020          |
| BGP-9   | 70             | 122             | 57.00             | 3.80                  | 10.60              | 3.80              | 7.50             | 5.00                   | 0.00                             | 370           |
| BGP-11  | 77             | 118             | 54.50             | 3.50                  | 24.50              | 4.10              | 11.50            | 3.00                   | 0.00                             | 950           |
| BGP-13  | 75             | 126             | 75.20             | 3.70                  | 21.60              | 1.70              | 9.00             | 5.00                   | 0.00                             | 830           |
| BGP-14  | 78             | 126             | 68.00             | 4.60                  | 15.70              | 3.30              | 8.50             | 5.00                   | 0.00                             | 840           |
| BGP-15  | 86             | 126             | 37.80             | 3.80                  | 12.10              | 1.80              | 15.50            | 5.00                   | 0.00                             | 120           |
| BGP-19  | 85             | 121             | 60.30             | 3.50                  | 25.70              | 4.70              | 6.00             | 5.00                   | 0.00                             | 820           |
| BGP-21  | 83             | 122             | 59.20             | 3.90                  | 36.50              | 3.30              | 6.50             | 7.00                   | 0.00                             | 300           |
| BGP-24  | 83             | 124             | 56.80             | 4.20                  | 13.90              | 3.20              | 7.50             | 7.00                   | 0.00                             | 200           |
| BGP-25  | 74             | 121             | 51.00             | 4.00                  | 24.25              | 3.70              | 6.00             | 7.00                   | 0.00                             | 450           |
| BGP-31  | 71             | 121             | 50.50             | 3.10                  | 37.70              | 2.50              | 7.00             | 7.00                   | 5.00                             | 720           |
| BGP-40  | 80             | 126             | 89.40             | 4.90                  | 20.10              | 2.40              | 14.00            | 7.00                   | 5.00                             | 940           |
| BGP-43  | 66             | 112             | 40.80             | 3.60                  | 10.10              | 3.40              | 5.50             | 7.00                   | 5.00                             | 500           |
| BGP-46  | 68             | 119             | 69.90             | 3.70                  | 32.40              | 2.60              | 6.50             | 3.00                   | 0.00                             | 1250          |
| BGP-48  | 81             | 126             | 60.20             | 3.30                  | 32.80              | 2.70              | 8.00             | 3.00                   | 5.00                             | 340           |
| BGP-51  | 86             | 122             | 56.40             | 3.20                  | 23.20              | 3.80              | 6.00             | 5.00                   | 5.00                             | 210           |

| Entries | Days to flower | Days to harvest | Plant height (cm) | No. of branch / plant | No. of pods/ plant | No. of seed / pod | 100 seeds wt (g) | Rust score (1-9 scale) | Powdery Mildew score (0-5 scale) | Yield (kg/ha) |
|---------|----------------|-----------------|-------------------|-----------------------|--------------------|-------------------|------------------|------------------------|----------------------------------|---------------|
| BGP-53  | 75             | 122             | 79.70             | 4.30                  | 26.10              | 2.50              | 8.00             | 3.00                   | 5.00                             | 780           |
| BGP-54  | 70             | 116             | 53.50             | 3.50                  | 35.20              | 3.30              | 6.50             | 5.00                   | 5.00                             | 300           |
| BGP-58  | 77             | 126             | 73.60             | 4.20                  | 22.30              | 2.50              | 8.00             | 3.00                   | 5.00                             | 631           |
| BGP-64  | 72             | 121             | 67.40             | 3.80                  | 53.70              | 3.20              | 8.50             | 3.00                   | 0.00                             | 1530          |
| BGP-66  | 86             | 126             | 73.75             | 4.10                  | 34.80              | 3.30              | 16.00            | 3.00                   | 5.00                             | 1010          |
| BGP-71  | 81             | 124             | 56.65             | 3.70                  | 39.70              | 4.00              | 7.00             | 5.00                   | 5.00                             | 730           |
| BGP-78  | 80             | 126             | 86.10             | 3.90                  | 37.30              | 3.10              | 8.00             | 5.00                   | 5.00                             | 930           |
| BGP-80  | 80             | 120             | 66.35             | 3.05                  | 32.57              | 3.00              | 12.50            | 3.00                   | 0.00                             | 1220          |
| BGP-88  | 79             | 126             | 78.30             | 3.40                  | 24.40              | 2.10              | 7.50             | 5.00                   | 5.00                             | 950           |
| BGP-95  | 77             | 123             | 49.20             | 3.00                  | 15.80              | 3.00              | 8.50             | 3.00                   | 5.00                             | 420           |
| BGP-98  | 75             | 122             | 65.80             | 4.60                  | 24.10              | 3.40              | 6.00             | 5.00                   | 5.00                             | 730           |
| BGP-101 | 80             | 119             | 57.00             | 3.90                  | 26.40              | 3.90              | 5.50             | 3.00                   | 5.00                             | 870           |
| BGP-105 | 74             | 122             | 62.60             | 3.80                  | 20.60              | 2.60              | 8.50             | 5.00                   | 0.00                             | 820           |
| BGP-108 | 72             | 126             | 93.30             | 3.90                  | 48.50              | 2.60              | 8.50             | 3.00                   | 0.00                             | 1560          |
| BGP-115 | 86             | 119             | 57.50             | 3.40                  | 21.80              | 5.20              | 6.50             | 5.00                   | 0.00                             | 530           |
| BGP-121 | 80             | 126             | 90.10             | 3.60                  | 35.80              | 2.80              | 8.00             | 3.00                   | 0.00                             | 1130          |
| BGP-122 | 79             | 122             | 66.40             | 3.30                  | 29.90              | 3.20              | 6.50             | 5.00                   | 0.00                             | 570           |
| BGP-128 | 80             | 126             | 99.50             | 2.90                  | 30.30              | 1.90              | 7.00             | 3.00                   | 1.67                             | 1430          |
| BGP-131 | 84             | 122             | 66.40             | 3.50                  | 10.20              | 3.40              | 5.50h            | 5.00                   | 0.00                             | 280           |
| BGP-136 | 75             | 119             | 40.25             | 3.05                  | 29.20              | 3.00              | 6.00             | 5.00                   | 0.00                             | 1060          |
| BGP-140 | 92             | 130             | 47.70             | 3.50                  | 11.80              | 2.80              | 5.00             | 7.00                   | 0.00                             | 370           |
| BGP-142 | 79             | 119             | 58.25             | 3.60                  | 30.90              | 3.80              | 7.00             | 7.00                   | 0.00                             | 300           |

| Entries | Days to flower | Days to harvest | Plant height (cm) | No. of branch / plant | No. of pods/ plant | No. of seed / pod | 100 seeds wt (g) | Rust score (1-9 scale) | Powdery Mildew score (0-5 scale) | Yield (kg/ha) |
|---------|----------------|-----------------|-------------------|-----------------------|--------------------|-------------------|------------------|------------------------|----------------------------------|---------------|
| BGP-143 | 88             | 121             | 59.90             | 3.90                  | 35.10              | 4.30              | 6.00             | 7.00                   | 0.00                             | 220           |
| BGP-148 | 82             | 123             | 61.70             | 3.90                  | 24.90              | 3.90              | 7.50             | 7.00                   | 0.00                             | 631           |
| BGP-150 | 74             | 126             | 72.40             | 3.20                  | 32.20              | 2.70              | 7.50             | 7.00                   | 0.00                             | 980           |
| BGP-156 | 69             | 124             | 67.20             | 3.50                  | 11.30              | 2.20              | 6.50             | 5.00                   | 1.67                             | 920           |
| BGP-157 | 85             | 122             | 65.70             | 5.00                  | 18.10              | 4.20              | 6.00             | 5.00                   | 0.00                             | 450           |
| BGP-158 | 80             | 123             | 53.40             | 3.00                  | 9.10               | 2.30              | 6.00             | 5.00                   | 0.00                             | 150           |
| BGP-159 | 81             | 124             | 52.25             | 4.90                  | 19.10              | 3.20              | 7.50             | 3.67                   | 1.67                             | 170           |
| BGP-169 | 77             | 122             | 59.20             | 3.50                  | 25.30              | 4.30              | 7.50             | 5.00                   | 0.00                             | 520           |
| BGP-170 | 80             | 119             | 52.80             | 3.90                  | 19.60              | 3.70              | 5.50             | 5.00                   | 5.00                             | 570           |
| BGP-186 | 77             | 121             | 54.70             | 3.70                  | 32.30              | 4.10              | 6.50             | 5.00                   | 5.00                             | 1000          |
| BGP-188 | 74             | 126             | 65.90             | 3.20                  | 35.10              | 2.40              | 9.00             | 5.00                   | 5.00                             | 1000          |
| BGP-189 | 89             | 122             | 49.60             | 3.50                  | 8.80               | 4.00              | 6.00             | 3.00                   | 5.00                             | 150           |
| BGP-190 | 78             | 126             | 63.20             | 3.70                  | 38.30              | 1.90              | 7.00             | 3.00                   | 5.00                             | 651           |
| BGP-198 | 75             | 126             | 61.40             | 3.70                  | 16.80              | 2.20              | 7.50             | 3.00                   | 5.00                             | 450           |
| BGP-199 | 74             | 121             | 61.80             | 4.00                  | 20.20              | 2.90              | 6.50             | 3.00                   | 5.00                             | 970           |
| BGP-202 | 69             | 116             | 48.40             | 3.20                  | 18.10              | 3.90              | 5.00             | 3.00                   | 5.00                             | 500           |
| BGP-204 | 89             | 121             | 59.80             | 4.20                  | 17.20              | 3.80              | 5.00             | 3.00                   | 5.00                             | 440           |
| BGP-205 | 78             | 119             | 61.10             | 3.70                  | 16.50              | 3.50              | 7.00             | 3.00                   | 5.00                             | 780           |
| BGP-206 | 84             | 123             | 85.10             | 4.10                  | 19.10              | 3.80              | 7.50             | 3.00                   | 5.00                             | 580           |
| BGP-209 | 80             | 122             | 58.00             | 3.90                  | 25.90              | 4.10              | 5.00             | 5.00                   | 5.00                             | 700           |
| BGP-216 | 76             | 126             | 95.80             | 3.20                  | 21.40              | 2.20              | 8.00             | 5.00                   | 5.00                             | 950           |
| BGP-218 | 69             | 112             | 59.50             | 3.70                  | 26.80              | 3.50              | 5.00             | 5.00                   | 5.00                             | 380           |

| Entries         | Days to flower | Days to harvest | Plant height (cm) | No. of branch / plant | No. of pods/ plant | No. of seed / pod | 100 seeds wt (g) | Rust score (1-9 scale) | Powdery Mildew score (0-5 scale) | Yield (kg/ha) |
|-----------------|----------------|-----------------|-------------------|-----------------------|--------------------|-------------------|------------------|------------------------|----------------------------------|---------------|
| BGP-220         | 75             | 122             | 65.60             | 3.90                  | 28.00              | 2.80              | 7.50             | 5.00                   | 5.00                             | 670           |
| BGP-221         | 68             | 122             | 69.00             | 3.60                  | 23.50              | 3.30              | 7.00             | 5.00                   | 5.00                             | 880           |
| BGP-222         | 81             | 126             | 80.50             | 3.20                  | 28.70              | 2.00              | 9.00             | 5.00                   | 5.00                             | 730           |
| BGP-225         | 78             | 117             | 39.10             | 3.10                  | 10.80              | 4.10              | 5.50             | 7.00                   | 5.00                             | 160           |
| BGP-226         | 82             | 121             | 43.50             | 2.70                  | 15.40              | 4.10              | 5.00             | 7.00                   | 5.00                             | 700           |
| BGP-227         | 91             | 124             | 54.65             | 3.95                  | 6.70               | 3.10              | 5.50             | 7.00                   | 5.00                             | 120           |
| BGP-230         | 83             | 119             | 81.95             | 3.00                  | 37.20              | 2.10              | 6.00             | 3.00                   | 0.00                             | 1310          |
| BGP-233         | 85             | 116             | 73.00             | 3.70                  | 26.60              | 4.80              | 6.00             | 7.00                   | 5.00                             | 890           |
| BGP-244         | 79             | 121             | 54.50             | 3.50                  | 20.90              | 3.60              | 7.00             | 7.00                   | 5.00                             | 660           |
| BGP-255         | 86             | 118             | 72.00             | 3.68                  | 38.55              | 3.05              | 5.50             | 3.00                   | 0.00                             | 1310          |
| BARI Keshhari-3 | 78             | 117             | 39.10             | 3.10                  | 34.80              | 4.10              | 5.50             | 5.00                   | 0.00                             | 1020          |
| CV (%)          | 6.17           | 1.76            | 12.78             | 12.71                 | 9.71               | 6.27              | 7.66             | 2.69                   | 0.21                             | 8.86          |
| LSD (0.05)      | 9.65           | 4.27            | 16.14             | 0.93                  | 19.69              | 1.04              | 1.70             | 20.14                  | 0.92                             | 209.4         |

With the findings of the study it could be concluded that under field condition the grasspea lines BGP-46, BGP-64, BGP-80, BGP-108, BGP-121, BGP-128, BGP-230 and BGP-255 showed resistant reaction in relating to rust and powdery mildew and produced better yields than the check BARI Khesari-3, where BGP-108 was the best.

### References

- Bhatia, J. N., and D. P. Thakur, 1989. Field evaluation of systemic and non-systemic fungicides against powdery mildew of different economic crops. *Indian Phytopath.* **42** (4):573
- Brahmaprakash, G.P., H.C. Girisha, Vithal Navi and S.V. Hedge. 2004. Biological Nitrogen Fixation in Pulse Crops. Masood Ali, B.B. Singh, Shiv Kumar and Vishwa Dhar (Eds.). *In Pulses in New Perspective*. Indian Society of Pulses Research and Development, IIPR, Kanpur, India. 543 P.
- Hanbury C.D., C.L. White, B.P. Mullan, K.H.M. Siddique. 2000. A review of the potential of *Lathyrus sativus* L. and *L. cicera* L. grain for use as animal feed. *Animal Feed Technology.* **87**: 1–27.
- Krishi Diary. 2017. Agriculture Information Services, DAE, Ministry of Agriculture. 18p.
- Morall, R. A. A., and D. L. McKenzie 1974. *Plant Disease Reporter.* **58**:342-345.
- Palmer, V.S., A.K. Kaul and P.S. Spencer. 1989. International Network for the improvement of *Lathyrus sativus* and the eradication of lathyrism (INILSEL): A TWMRF initiative. *In: The Grasspea: Theat and promise* (Eds. P.S. Spencer). Third World Medical Research Foundation. New York, USA. Pp. 219-223.
- Steel, R. G. D. and J. H. Torrie. 1960. *Principles and Procedures of Statistics*, McGraw-Hill Book. Co. Lnc., New York. Pp. 107-109.