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## Evaluation of Different Varieties, Seed Rates and Row Spacing of Groundnut, Planted under Agro-Ecological Conditions of Malakand Division

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**Abstract:** Studies were carried out to evaluate different varieties, seed rates and row spacing of groundnut planted at the Agriculture Research Institute (N) Mingora, Swat to find the most suitable seed rate and row spacing for cultivation of different promising groundnut varieties in the area. Based on yield and yield components data, it was concluded that among different varieties, the highest pod yield of 3738 kg ha<sup>-1</sup> was recorded for variety SP-2002. Among different seed rates, the highest pod yield of 3808 kg ha<sup>-1</sup> was recorded for S3 (60 kg acre<sup>-1</sup>), while among different row spacing, highest pod yield of 3739 kg ha<sup>-1</sup> was recorded for R1 (30 cm). The interaction between varieties, seed rates and row spacing revealed that highest pod yield of 5784 kg ha<sup>-1</sup> was recorded for treatment # T7 (var. SP-2000, 60 kg acre<sup>-1</sup>, 30 cm) at 5% level of significance followed by treatment # T16 (var. SP-2002, 60 kg acre<sup>-1</sup>, 30 cm) and # T13 (var. SP-2002, 40 kg acre<sup>-1</sup>, 30 cm) with pod yield of 5312 and 5284 kg ha<sup>-1</sup>, respectively. It is therefore suggested that variety SP-2002 may be recommended to the farmers for cultivation in the area at a seed rate of 60 kg acre<sup>-1</sup> and row spacing of 30 cm.

**Key words:** Evaluation, seed rates, row spacing, varieties, pod yield, kernel/pod

### INTRODUCTION

Groundnut (*Arachis hypogaea* L.) belongs to an important family leguminosae. It is an oilseed crop with 40-50 % oil contents. The remaining portion can be used as meal for food or feed (25-30% proteins). As a crop groundnut ranks 13th in importance in the world (Hatam and Abbasi, 1994). In Pakistan it was grown on an area of 102400 hectares with a total production of 114700 tons and an average yield of 1121 kg ha<sup>-1</sup> (GOP, 2004). In NWFP during the same period it was grown on an area of 9100 ha with a total production of 13900 tons and an average yield of 1525 kg ha<sup>-1</sup> (GOP, 2004). Groundnut is a potential crop for both rain-fed and irrigated lands of Malakand Division and can easily be adjusted in the prevailing cropping patterns. Muldoon (1998) reported that White Spanish, Red Spanish and Virginia Bunch cultivars of *Arachis hypogaea* L. were sown at two row spacing (30 and 60 cm) and two times (29 October and 3 December). Maximum oven dry pod yields were 3.0, 2.3 and 3.3 t ha<sup>-1</sup> for white Spanish, Red Spanish and Virginia Bunch respectively. He suggested that White Spanish or Virginia Bunch sown in 30 cm rows before December can be recommended for irrigated groundnut production. Kaushik and Chaubey (2000) conducted a field study with groundnut (*Arachis hypogaea* L.) cv.

Kaushal (G 201) to ascertain the effect of row spacing and seed rate on the production potential. The results revealed that potential production from bunch groundnut could be secured by keeping inter-row spacing of 30 cm with the seed rate of 60 kg kernel ha<sup>-1</sup>. Baldwin *et al.* (1999) determined the response of peanut when planting in single or twin row patterns by strip-tillage or no-tillage methods. During 1997 and 1998 the peanut cultivars Georgia Green and Georgia Runner or Georgia Green and Georgia Bold (*Arachis hypogaea* L.) were planted in 9.5 or 9.0 inch twin row patterns versus 36 inch single row at the same seeding rate (6 seed foot<sup>-1</sup> single or 3 seed foot<sup>-1</sup> twin). In both years, there was a trend toward higher yields with the twin row pattern. James *et al.* (2004) reported that cultivars NC-V 11, NC 12 C, VA 98 R and Perry were compared in single row (rows spaced 91 cm apart) and standard twin row (two rows spaced 18 cm apart on 91 cm centers). Peanut pod yield was higher in standard twin row planting patterns than when grown in single row planting patterns. Pod yield of bunch-type peanut was 16% higher when peanut was seeded in rows spaced 46 cm apart compared with 91 cm Norden and Lipscomb, 1974 and Duke and Alexander (1964) reported pod yield that was 14% higher in narrow row plantings compared with traditional wider row patterns using large-seeded virginia bunch-type peanut. Spanish market type

peanut planted in 46 cm rows yielded higher than peanut planted in rows spaced 61, 76, 91, or 107 cm apart at similar in-row plant populations. Crop response to seeding rate can be affected by cultivar selection (Costa *et al.*, 1980; Ablett *et al.*, 1984; Beuerlein, 1988; Nafziger, 1994; Porter *et al.*, 1997).

The present study was aimed to investigate and select the high yielding variety of groundnut at proper seed rate and row spacing for its cultivation in Malakand Division.

### MATERIALS AND METHODS

The improved groundnut genotypes SP-2002, SP-2000 and SP-96 were planted at the Agriculture Research Institute, Mingora, Swat, Pakistan to study their optimum row spacing and seed rate. For this purpose an experiment was laid out in a split-split plot arrangement with different varieties assigned to main plots, seed rates of 20, 40 and 60 kg acre<sup>-1</sup> assigned to sub plots and row spacing of 30, 45 and 60 cm were assigned to sub-sub plots. The experiment was replicated 3 times. The recommended dose of fertilizer at the rate of 25: 50: 30 kg ha<sup>-1</sup> NPK was applied at the time of seed bed preparation. The plot size measured 4 × 1.8 m or 7.2 m<sup>2</sup> (4 rows, 4 m long with spacing of 45 cm). All recommended cultural practices and pest control operation were carried out as required to grow a good crop. Two irrigations were applied during the whole cropping season. The first irrigation was applied one month after emergence, while the second one was applied at the time of pegs penetration in the soil. Digging of the pods was started at maturity. The plants from each plot were labeled and kept separated. The pods were collected and yield data in kg ha<sup>-1</sup> were recorded. Necessary agronomic and plant protection measures were adopted at appropriate intervals to raise a good crop. The seed yield and other relevant data on different varieties were collected as according to standard procedure. The data was statistically analyzed according to the appropriate design and means were compared using Least Significant Difference (LSD) test.

### RESULTS AND DISCUSSION

**Pods plant<sup>-1</sup>:** Significant differences were observed for pods plant<sup>-1</sup> among different varieties at (p<0.5). Highest number of pods (26.3) were recorded for V1 (SP-2000), while lowest number of pods plant<sup>-1</sup> (18.3) were recorded for V3 (SP-96) (Table 1). Among different seed rates, non-significant variation was observed at (p<0.5) for pods plant<sup>-1</sup> (Table 2). Among different row spacing, significant variation was observed at (p<0.5) with highest

number of pods recorded for R1 (30 cm), while the lowest number of pods recorded for R3 (60 cm) (Table 3). The interactions b/w varieties, seed rates and row spacing remained non-significant (Table 4). These results are in agreement with Muldoon (1998) who reported that White Spanish or Virginia Bunch sown in 30 cm rows can be recommended for irrigated groundnut production.

Table 1: Yield and other data recorded on different varieties of SRV trial

| Varieties    | Pods plant <sup>-1</sup> | 100 kernel weight (g) | Pod yield (kg ha <sup>-1</sup> ) |
|--------------|--------------------------|-----------------------|----------------------------------|
| V1 (SP-2000) | 26.3 a                   | 68.8ab                | 3481a                            |
| V2 (SP-2002) | 25.8 a                   | 72.4a                 | 3738a                            |
| V3 (SP-96)   | 18.3 b                   | 64.5b                 | 2010b                            |
| LSD          | 4.83                     | 6.0                   | 202.4                            |

Table 2: Yield and other data recorded on different seed rates of SRV trial

| Seed rate (kg acre <sup>-1</sup> ) | Pods plant <sup>-1</sup> | 100 kernel weight (g) | Pod yield (kg ha <sup>-1</sup> ) |
|------------------------------------|--------------------------|-----------------------|----------------------------------|
| S1 (20)                            | 22.9                     | 62.0b                 | 2480c                            |
| S2 (40)                            | 23.4                     | 68.7ab                | 2942b                            |
| S3 (60)                            | 24.0                     | 75.1a                 | 3808a                            |
| LSD                                | NS                       | 10.6                  | 677.3                            |

Table 3: Yield and other data recorded on different row spacing of SRV trial

| Row space (cm) | Pods plant <sup>-1</sup> | 100 kernel weight (g) | Pod yield (kg ha <sup>-1</sup> ) |
|----------------|--------------------------|-----------------------|----------------------------------|
| R1 (30)        | 27.1 a                   | 69.1                  | 3739 a                           |
| R2 (45)        | 22.8 ab                  | 67.8                  | 3458 b                           |
| R3 (60)        | 20.4 b                   | 68.9                  | 1903 c                           |
| LSD            | 4.8                      | NS                    | 202.4                            |

Table 4: Yield and other data of interaction b/w different varieties, seed rates and row spacing of SRV trial

| Treatments (V X S X R) | Pods plant <sup>-1</sup> | 100 kernel weight (g) | Pod yield (kg ha <sup>-1</sup> ) |
|------------------------|--------------------------|-----------------------|----------------------------------|
| V1 X S1X R1            | 21.000                   | 63.833 d-g            | 2847 gh                          |
| V1 X S1 X R2           | 31.443                   | 75.233 a-e            | 3495 def                         |
| V1 X S1 X R3           | 33.330                   | 56.133 g-h            | 2434 hj                          |
| V1 X S2 X R1           | 20.667                   | 61.700 dh             | 3388 d-g                         |
| V1 X S2 X R2           | 27.443                   | 69.767 b-g            | 3888 bcd                         |
| V1 X S2 X R3           | 28.687                   | 81.200 abc            | 2239 iu                          |
| V1 X S3X R1            | 21.000                   | 73.467 a-f            | 5784 a                           |
| V1 X S3 X R2           | 31.780                   | 82.567 abc            | 4467 b                           |
| V1 X S3 X R3           | 20.997                   | 84.933 ab             | 2784 ghi                         |
| V2 X S1 X R1           | 23.553                   | 66.867 c-h            | 4166 BC                          |
| V2 X S1 X R2           | 27.443                   | 59.267 e-h            | 3662 cde                         |
| V2 X S1 X R3           | 21.110                   | 59.500 e-h            | 1628 kl                          |
| V2 X S2 X R1           | 27.223                   | 72.133 a-g            | 5284 a                           |
| V2 X S2 X R2           | 30.333                   | 57.233 fgh            | 4217 bc                          |
| V2 X S2 X R3           | 22.557                   | 76.733 a-d            | 2187 luk                         |
| V2 X S 3X R1           | 23.557                   | 87.867 a              | 5312 a                           |
| V2 X S3 X R2           | 30.443                   | 70.900 a-g            | 4259 bc                          |
| V2 X S3 X R3           | 25.777                   | 71.500 a-g            | 2927 fgh                         |
| V3 X S1 X R1           | 12.777                   | 52.467 h              | 1458 lm                          |
| V3 X S1 X R2           | 21.997                   | 62.500 d-h            | 1828 gkl                         |
| V3 X S1 X R3           | 14.333                   | 61.467 d-h            | 798 n                            |
| V3 X S2 X R1           | 17.110                   | 76.000 a-e            | 2083 jk                          |
| V3 X S2 X R2           | 19.333                   | 66.700 c-h            | 2175 jk                          |
| V3 X S2 X R3           | 17.220                   | 57.467 fgh            | 1013 mn                          |
| V3 X S 3X R1           | 17.110                   | 70.000 bg             | 3680 cde                         |
| V3 X S3 X R2           | 23.553                   | 66.300 c-h            | 3125 efg                         |
| V3 X S3 X R3           | 21.553                   | 67.900 b-h            | 1927 jkl                         |
| LSD                    | NS                       | 17.1                  | 607.1                            |

**100 kernel weight (g):** Significant differences were observed for 100 kernel weight among different varieties at ( $p \leq 0.5$ ). Highest 100 kernel weight (72.4 g) was recorded for V2 (SP-2002), while lowest 100 k. wt. (64.5 g) was recorded for V3 (SP-96) (Table 1). Among different seed rates, significant variation was observed at ( $p \leq 0.5$ ) for 100 k. wt. (Table 2). It was observed that S3 (60 kg acre<sup>-1</sup>) had the highest (75.1 g) 100 k. wt., while S1 (20 kg acre<sup>-1</sup>) had the lowest (62.0 g) 100 kernel wt. Non-significant variation was observed among different row spacing, at ( $p \leq 0.5$ ) (Table 3). The interactions b/w varieties, seed rates and row spacing revealed significant variation at ( $p \leq 0.5$ ) (Table 4). It was observed that treatment #. 16 (V2 x S3 x R1) had the highest 100 kernel weight (87.9 g), while the lowest 100 kernel wt. (52.5 g) was recorded for treatment #. 19 (V3 x S1 x R1). The results are in agreement with Kaushik and Chaubey (2000) who reported that potential production from bunch groundnut could be secured by keeping inter-row spacing of 30 cm with the seed rate of 60 kg (kernel ha<sup>-1</sup>).

**Pod yield (kg ha<sup>-1</sup>):** Significant variation at ( $p \leq 0.5$ ) was observed for pod yield (kg ha<sup>-1</sup>) among different varieties. Highest pod yield (3738 kg ha<sup>-1</sup>) was recorded for V2 (SP-2002), while lowest pod yield of 2010 kg ha<sup>-1</sup> was recorded for V3 (SP-96) (Table 1). Among different seed rates, significant variation was observed at ( $p \leq 0.5$ ). It was observed that seed rate of 60 kg acre<sup>-1</sup> (S3) had the highest pod yield of 3808 kg ha<sup>-1</sup>, while lowest pod yield of 2480 kg ha<sup>-1</sup> was recorded for seed rate of 20 kg acre<sup>-1</sup> (S1) (Table 2). Among different row spacing, significant variation was observed at ( $p \leq 0.5$ ) with highest pod yield (3739 kg ha<sup>-1</sup>) recorded for R1 (30 cm), while the lowest pod yield (1903 kg ha<sup>-1</sup>) recorded for R3 (60 cm) (Table 3). The interactions b/w varieties, seed rates and row spacing also revealed significant differences at ( $p \leq 0.5$ ). It was observed that treatment No. 7 (V1 x S3 x R1) had significantly high pod yield of 5784 kg ha<sup>-1</sup>, followed by treatment No. 16 (V2 x S3 x R1) with pod yield of 5312 kg ha<sup>-1</sup>, followed by treatment No. 13 (V2 x S2 x R1) with pod yield of 5284 kg ha<sup>-1</sup>, while the lowest pod yield of 798 kg ha<sup>-1</sup> was recorded for treatment No. 21 (V3 x S1 x R3) (Table 4). These results are in agreement with Muldoon (1998) who reported that White Spanish or Virginia Bunch sown in 30 cm rows can be recommended for irrigated groundnut production. Kaushik and Chaubey (2000) reported that potential production from bunch groundnut could be secured by keeping inter-row spacing of 30 cm with the seed rate of 60 kg kernel ha<sup>-1</sup>. Norden and Lipscomb (1974) reported that pod yield of bunch-type peanut was 16% higher when peanut was seeded in rows spaced 46 cm apart compared with 91 cm. Duke and Alexander (1964) reported pod yield that was 14% higher in narrow row plantings compared with traditional wider

row patterns using large-seeded Virginia bunch-type peanut. Spanish market type peanut planted in 46 cm rows yielded higher than peanut planted in rows spaced 61, 76, 91, or 107 cm apart at similar in-row plant populations.

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