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Yield Response of Groundnut Genotypes under the Sub-mountainous Conditions of Malakand Division (NWFP), Pakistan

¹Ayub Khan, ¹M. Rahim, ¹Amjad Khan and ²M. Idrees Khan

¹Agriculture Research Station, Mingora (NWFP), Pakistan

²Sugarcane Breeding Station, Dargai, Malakand Agency (NWFP), Pakistan

Abstract: Field experiments on 12 groundnut genotypes were carried out at three different locations of Malakand Division. Significant differences were noted for maturity duration, pod plant⁻¹, kernel pod⁻¹, shelling%, 100-kernel weight and pod yield, among the locations, genotypes and location X genotype interaction. Maturity was earlier at Cheena, with minimum pod plant⁻¹ and kernel pod⁻¹. Among the genotypes, PG-931 and PI-338337 were earliest in maturity. PG-931 also had maximum pods plant⁻¹ whereas PI-338337 had maximum kernel pod⁻¹. 100-kernel weight was higher at Cheena. PG-951 (74.91%) and PG-864 (74.12%) produced maximum shelling % at all the locations. The highest pod yield of 3167 Kg ha⁻¹ and 2750 kg ha⁻¹ were recorded at Mingora and Cheena, respectively. Among the genotypes, PG-931 produced the maximum yield of 3685 Kg ha⁻¹, whereas minimum yield of 1583 kg ha⁻¹ was recorded for the check variety, Swat Phalli-96.

Key words: groundnut, genotypes, location, yield, Pakistan

Introduction

The production of local oilseed crops to meet our domestic edible oil consumption, is a big national concern, as edible oil import bill is touching Rs. 40 billion per year (MINFAL 2000). Our domestic production meet only 38 % of the total requirement. Groundnut is an important oilseed crop that can be grown very well under rainfed conditions. About 1746700 ha (58%) area of NWFP and 350077 ha (41%) area of Malakand Division remain fallow during kharif season. This results in annual low income from the rainfed lands and an increased soil erosion problem during monsoon rains. Groundnut, being a drought tolerant high income generating and environment friendly crop, can be a promising new crop for these rainfed conditions. Various researchers investigated the production potential of groundnut genotypes under different agro-ecological conditions. Taran *et al.* (1998) evaluated six groundnut genotypes at Lasbela (Balochistan) and reported significant differences for yield within the year and over the years. On average, variety ICGS (E)-46 gave maximum yield of 1341 kg ha⁻¹ with uniform maturity and minimum pod yield of 1225 kg ha⁻¹ was recorded for variety ICGS (E)-95. Prakash *et al.* (1998) tested groundnut variety R-8808 at five locations (Bijapur, Bellary, Lelgaum, Raichur and Dhavvad) at Karanataka and obtained 30% (1300 kg ha⁻¹) more yield than check variety JL-24 (1000 kg ha⁻¹) during 1995 and 1996. In an other experiment they reported that variety, R-8808 give the highest pod yield of 1200 kg ha⁻¹ against control variety JL-24 (1000 kg ha⁻¹). Similarly, maximum 100-kernel weight (29.3 g), shelling (63%) and oil content (47.2%) were recorded for variety R-8808 than JL-24 during 1993 to 1995. Kale *et al.* (1999) reported that groundnut variety TAG-24 produced significantly highest pod yield of 2665 kg ha⁻¹ against the local variety with 2032 kg ha⁻¹, in 11 varieties trial at Mumbai (Maharashtra), India. Manoharan *et al.* (1989) reported that cross JL-24 x Co-2, produced average pod yield of 1790 and 2060 kg ha⁻¹, under rainfed and irrigated conditions, respectively, at Uther Pradesh, India. The crop took 100-105 days to maturity. Perdido and Lopez (1996) reported that variety UPL Pn 8 gave significantly the highest pod yield of 1950 kg ha⁻¹ and matured in 110 days in Philippines. Perdido and Lopez (1996) also reported that variety UPL Pn 9, gave significantly the highest pod yield of 4410 and 4585 kg ha⁻¹ under irrigated and 2666 and 3227

kg ha⁻¹ under rainfed conditions. Rajeswari (1998) conducted an experiment on 11 groundnut genotypes and concluded that genotypes K 134, ICGS 65, and ICGS 44 were likely to be more adaptable to rainfed conditions of Northern Coastal zone of Andhra Pradesh, India. Khan and Rahim (1998) evaluated 13 genotypes of groundnut for two years at ARS, Swat and reported that genotypes SP-96 (4078 kg ha⁻¹), ICGS 99 (4074 kg ha⁻¹), ICGS 18 (4042 kg ha⁻¹) and BARD 699 (4016 kg ha⁻¹) produced significantly the highest pod yield. Santos (1998) reported that a large seeded groundnut variety for Brazil (BRS151 Amendoim L 7), produced average pod yield of 1850 kg ha⁻¹ under rainfed and 4500 kg ha⁻¹ under irrigated conditions. Gao *et al.* (1996) tested an early groundnut variety, Nonghua 22 at four locations in China. They reported an average pod yield of 4021 and 4116 kg ha⁻¹ during 1992 and 1993, respectively. Khan *et al.* (1998) evaluated 20 genotypes at Swat and reported that genotypes Cina (4528 kg ha⁻¹), BARD 479 (3889 kg ha⁻¹), PG 542 (3889 kg ha⁻¹), ICGS 50 (3889 kg ha⁻¹), ICGV 86028 (3798 kg ha⁻¹) and ICGS 7326 (3611 kg ha⁻¹) produced significantly the highest pod yield against SP-96 (check) with 2409 kg ha⁻¹. Therefore, this study was initiated to evaluate 12 high yielding groundnut varieties under the diverse climatic conditions of Malakand Division.

Materials and Methods

Field experiments were conducted at three locations in Malakand Division, viz., Agriculture Research Station, Mingora, Distt: Swat, Timergara, Distt: Dir and Cheena, Distt: Bunir during 1999 to study the production potential of 12 high yielding groundnut genotypes selected at ARS, Mingora. The genotypes were, PG-631, PG-951, PG-759, PG-931, PG-479, PG-864, PG-481, PI-275688, PI-429629, PI-338337, PI-565452 and Swat Phalli-96. All the locations had silt loamy soils, that were low in nitrogen and phosphorous while medium in potash. The experiments were laid out in Randomized Complete Block Design (RCBD) design with three replications on May 21st, May 24th, and May 27th, 1999, at Timergara, Cheena and Mingora, respectively. Experimental plot measured 4 x 1.8 m with inter and intra row spacing of 45 and 15 cm, respectively. A basal fertilizer dose of 25 kg N, 60 kg P₂O₅ and 30 kg K₂O ha⁻¹ were applied before sowing. Agronomic practices i.e., weeding hoeing, thinning, irrigation

and plant protection measures were carried out at appropriate time. Data were recorded on maturity duration (days), pod plant⁻¹, kernel pod⁻¹, shelling%, 100-kernel weight in gm and yield kg ha⁻¹. The data were subjected to the analysis of variance using MSTATC, a computer software package (Bricker 1991).

Results and Discussions

Maturity Duration: Significant differences (P0.05) in maturity were observed among the locations, genotypes and location X genotype interaction. The genotypes significantly matured earlier at Cheena followed by Mingora and Timergara (Table 1). Among the genotypes PG-931 and PI-338337 were the earliest and took 156.33 and 157.22 days respectively, to reach maturity. The check variety (Swat Phalli-96) and the genotypes PI-429624 and PG-759 took 166, 168 and 168 days, respectively, and were significantly late maturing than all the other genotypes in the test (Table 1). Location X genotypes interaction showed that most of the genotypes were not consistent in maturity at different locations. At Mingora, PG-864 and PG-481 were the earliest and PI-275688, PI-429624, PI-565452, PI-338337 and PG-631 were late in maturity.

Pod plant⁻¹: Significant differences (P0.05) in pods plant⁻¹ were observed among the locations, genotypes and location X genotype interaction. Pods plant⁻¹ were significantly higher at Timergara (45.43) followed by Mingora and Cheena (Table 2). Among the genotypes, PG-931 had the highest pod plant⁻¹ (53.57). The lowest pod plant⁻¹ (26.11) were recorded for genotype PI-338337. Variety X location interaction revealed that the highest pod plant⁻¹ were recorded for genotype PG-759 and PG-951 at Mingora.

Location x variety interaction revealed that genotypes PI-275688 at Timergara (65.0), PG-759 and PG-951 at Mingora (64.67 and 64.00, respectively) produced the highest number of pod plant⁻¹. At Cheena, all the genotypes had comparatively lower number of pod plant⁻¹. At these location, genotypes PG-931 had the maximum number of pod plant⁻¹(51.0).

Kernel pod⁻¹: Significant differences in kernel pod⁻¹ were observed among the locations, genotypes and their interaction. Kernel pod⁻¹ were highest at Timergara (2.08), followed by Mingora (1.99) and Cheena (1.98). Among the genotypes, PI-338337 had the highest kernel pod⁻¹ (2.39), followed by genotype PI-275688 (2.26). The lowest number of kernel pod⁻¹ (1.82) were recorded for PG-931.

Variety x location interaction revealed that genotype PI-275688 at Mingora (2.68), genotype PI-338337 at Timergara (2.71) and Cheena (2.4) had the highest kernel pod⁻¹ (Table 3). The lowest kernel pod⁻¹ were recorded for PG-931 (1.67) at Mingora (Table 3)

Shelling %: Significant differences in shelling percentage were observed among the locations, genotypes and their interaction.

Among the locations, Timergara had the highest shelling percentage (65.46) followed by Cheena (64.42) and then Mingora (54.58). Among the genotypes, PG-951 and PG-864 had the highest shelling percentage of 74.9 and 74.1, respectively (Table 4). Genotypes PI- 275688 and PI-429624 had the lowest shelling percentage of 50.6 and 50.17, respectively. Variety x location interaction revealed that PG-951 at Mingora (77.33), PI-338337 at Timergara (74.0) and PI-565452 at Cheena (75.33) had the highest shelling

percentage. The lowest shelling percentage of 31.03 was

Table 1: Days to maturity for 12 groundnut genotypes over three locations in Malakand Division.

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	170.0 A-C	167.7 B-E	144.3 M	160.67 DEF
PG-951	166.7 B-E	169.7 A-D	146.0 LM	160.78 DEF
PG-759	166.7 B-E	163.7 D-I	174.0 A	168.11 A
PG-931	164.7 C-H	158.3 J-J	146.0 LM	156.33 G
PG-479	165.0 C-H	160.3 F-J	150.7 KL	158.67 EFG
PG-864	163.0 E-I	160.0 G-J	162.0 E-I	161.67 CDE
PG-481	162.0 E-I	168.0 A-E	165.7 B-H	165.22 ABC
PI-275688	174.0 A	168.0 A-E	145.0 LM	162.33 CD
PI-429624	171.3 AB	168.0 A-E	166.3 B-F	168.56 A
PI-338337	168.0 A-E	159.7 H-J	144.0 M	157.22 FG
PI-565452	170.0 A-C	155.0 JK	166.7 B-E	163.89 BCD
Swat Phalli-96	166.0 B-G	162.0 E-I	170.3 A-B	166.11 AB
Means	167.28 A	163.36 B	156.75 C	

Values followed by same letters do not differ significantly at 5% level of probability.

Table 2: Pod plant⁻¹ of 12 groundnut genotypes over three locations at Malakand Division

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	53.00 CD	50.23 DE	41.88 FG	48.37 B
PG-951	64.00 AB	36.10 G-K	39.89 GH	46.66 B
PG-759	64.67 AB	38.02 G-J	46.26 EF	49.65 B
PG-931	51.00 DE	58.67 BC	51.03 DE	53.57 A
PG-479	54.00 CD	46.67 EF	25.36 NO	42.01 C
PG-864	31.00 K-N	35.00 H-N	32.99 I-M	32.99 D
PG-481	39.00 G-I	52.11 DE	33.68 H-M	41.59 C
PI-275688	29.00 L-N	65.00 A	30.67 K-N	41.52 C
PI-429624	33.00 I-M	33.00 I-M	36.55 G-K	34.18 D
PI-338337	25.00 NO	32.00 J-M	21.33 O	26.11 E
PI-565452	31.00 K-N	48.00 D-F	28.67 MN	35.89 D
Swat Phalli-96	35.00 H-N	50.33 DE	33.67 H-M	39.67 C
Means	42.47 B	45.43 A	35.16 C	

Values followed by same letters do not differ significantly at 5% level of probability.

Table 3: Kernel Pod⁻¹ of 12 groundnut genotypes over three locations at Malakand Division

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	1.89 G-J	2.07 C-G	1.77 JK	1.91 D-F
PG-951	1.89 G-J	1.97 E-I	2.00 D-H	1.95 DE
PG-759	2.00 D-H	2.07 C-G	1.80 I-K	1.96 DE
PG-931	1.67 K	1.87 H-J	1.93 F-J	1.82 F
PG-479	1.90 G-J	1.93 F-J	1.97 E-I	1.93 D-F
PG-864	1.79 I-K	1.90 G-J	2.00 D-H	1.90 EF
PG-481	1.87 H-J	2.00 D-H	2.00 D-H	1.96 DE
PI-275688	2.68 A	2.10 C-F	2.00 D-H	2.26 B
PI-429624	2.16 CD	2.00 D-H	1.87 H-J	2.01 D
PI-338337	2.00 D-H	2.71 A	2.40 B	2.39 A
PI-565452	2.13 C-E	2.20 C	2.07 C-G	2.13 C
Swat Phalli-96	1.96 E-I	2.03 C-H	1.93 F-J	1.98 DE
Means	1.99 AB	2.08 A	1.98 B	

Values followed by same letters do not differ significantly at 5% level of probability.

recorded for PI-275688 at Mingora Table 4. The differences in shelling percentage of different varieties was also reported by Prakash *et al.*, (1998).

100-kernel weight: 100-kernel weight was significantly affected (P0.05) by locations, genotypes and their interactions. 100-kernel weight was higher at Cheena (73.39 gm) as compared to the other two locations. Among the

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Table 4: Shelling % of 12 groundnut genotypes over three locations at Malakand Division

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	51.00 P	67.00 G	60.60 K	59.53 D
PG-951	77.33 A	71.00 E	86.40 AB	74.91 A
PG-759	60.40 K	65.00 H	58.40 LM	61.27 C
PG-931	54.18 O	65.00 H	56.80 N	58.66 E
PG-479	67.90 G	62.50 IJ	50.90 P	50.43 C
PG-864	74.87 CD	64.00 HI	73.50 D	74.12 A
PG-481	69.43 F	68.00 FG	58.70 L	64.38 B
PI-275688	31.03 S	64.00 HI	56.80 N	50.61 F
PI-429624	35.27 R	56.00 L-N	57.00 MN	50.09 F
PI-338337	60.47 K	74.00 CD	61.20 JK	65.22 B
PI-565452	40.73 Q	61.00 JK	75.33 BC	59.02 DE
Swat Phalli-96	52.33 P	63.00 I	60.35 K	58.56 E
Means	54.58 C	65.46 A	64.42 B	

Values followed by same letters do not differ significantly at 5% level of probability.

Table 5: 100-kernel weight of 12 groundnut genotypes over three locations at Malakand Division

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	63.50 F-I	65.27 FG	65.22 FG	64.66 F
PG-951	96.93 A	96.16 A	95.79 A	96.79 A
PG-759	82.00 B	83.44 B	82.23 B	82.56 C
PG-931	84.49 B	68.90 C-F	84.97 B	79.45 CD
PG-479	75.09 C	67.67 D-F	93.30 A	78.69 D
PG-864	92.73 A	94.54 A	84.67 B	90.64 B
PG-481	64.82 F-H	68.32 D-F	93.97 CD	69.04 E
PI-275688	57.26 ID	59.69 H-J	59.37 G-J	58.44 G
PI-429624	38.56 KL	39.17 KL	71.71 C-E	49.81 H
PI-338337	38.64 KL	44.32 K	43.67 K	42.21 I
PI-565452	36.55 L	39.51 KL	65.73 E-G	47.26 H
Swat Phalli-96	53.83 J	56.38 J	60.14 G-J	56.78 G
Means	65.37 B	65.19 B	73.39 A	

Values followed by same letters do not differ significantly at 5% level of probability.

Table 6: Pod yield of 12 groundnut genotypes over three locations at Malakand Division.

Genotypes	Locations			
	Mingora	Timergara	Cheena	Means
PG-631	2889 F-J	2250 J-M	2528 H-J	2556 D
PG-951	2750 G-J	1806 L-N	3556 A-E	2704 CD
PG-759	3639 A-D	1694 MN	3944 AB	3092 BC
PG-931	3833 AB	3139 C-H	4083 A	3685 A
PG-479	3778 A-C	3139 C-H	2389 I-L	3102 B
PG-864	3944 AB	2528 H-J	2750 G-J	3074 BC
PG-481	2917 E-D	2972 D-I	2500 H-K	2796 B-D
PI-275688	3306 B-G	2528 H-K	2611 H-J	2815 B-D
PI-429624	3472 A-F	1806 LN	3361 B-G	2880 B-D
PI-338337	3778 A-C	2889 F-J	1639 MN	2769 B-D
PI-565452	1861 K-N	1361 N	2278 J-M	1833 E
Swat Phalli-96	1667 MN	1639 MN	1444 N	1583 E
Means	3167 A	2306 B	2750 AB	

Values followed by same letters do not differ significantly at 5% level of probability.

genotypes PG-951 had the highest 100-kernel weight of 96.79 gm followed by 90.64 gm by genotypes PG-864. PI-338337 had the lowest (42.21 gm) 100-kernel weight. Variety x location interaction revealed that PG-951 at all the locations and PG-864 at Mingora and Timergara had the highest 100-kernel weight. The lowest 100-kernel weight of 36.55 gm was recorded for genotype PI-565452 at Mingora (Table 5). The results are in agreement with the findings of Prakash *et al.*, (1998).

Pod yield: Significant differences (P<0.05) in pod yield were noted among the locations. Pod yield was higher at Mingora (3167 kg ha⁻¹) and Cheena (2750 kg ha⁻¹). Among the varieties, PG-931 had the highest pod yield (3685 kg ha⁻¹) followed by variety PG-479 (3102 kg ha⁻¹). The minimum pod yield of 1583 and 1833 kg ha⁻¹ were noted for genotypes Swat Phalli-96 and PI-565452, respectively. Variety X location interaction was also significant (P<0.05). At Mingora, genotypes, PG-864, PG-931, PG-479 and PI-338337 were the significantly highest yielding genotypes with 3944, 3833, 3778 and 3778 kg ha⁻¹, respectively, and minimum pod yield of 1667 kg ha⁻¹ was noted for variety Swat Phalli-96. At Timergara, genotypes PG-931 and PG-479 retained their superiority in high yield with 3139 kg ha⁻¹ each, and significantly minimum yield of 1639 and 1694 kg ha⁻¹ were recorded for genotypes Swat Phalli-96 and PG-759. At Cheena, genotypes PG-931, PG-759 and PG-951 were the significantly highest yielding genotypes with their respective yield of 4083, 3944 and 3556 kg ha⁻¹. While variety Swat Phalli-96 give significantly the lowest pod yield of 1444 kg ha⁻¹, followed by variety PI-338337 with 1639 kg ha⁻¹. The variation in pod yield for different varieties under different environments also reported by Manoharan *et al.* (1989), Kale *et al.* (1999), Khan *et al.* (1998), Rajaswari (1998), Khan and Rahim (1998) and Gao *et al.* (1996).

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