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## Yield Potential of Cowpea Germplasm

Amanullah and Mir Hatam

Department of Agronomy, NWFP Agricultural University, Peshawar, Pakistan

**Abstract:** Grain yield potential of 20 cowpea (*Vigna unguiculata* (L.) Walp) germplasm collected from FATA (Federally Administered Tribal Areas) and neglected pockets of NWFP was tested at the Research Farm of NWFP Agricultural University Peshawar during summer 1997. Based on the grain yield potential, the germplasm were divided into three groups in descending order.

Germplasm SW.C.31 ranked first by producing maximum yield of 2028 kg/ha, while germplasm SW.C.8 with 1724 kg/ha ranked second. Minimum yield of 22.7 kg/ha was obtained by CH.C.302, followed by SW.C.15 with 26.7 kg/ha. The germplasm in group I viz. SW.C.31, SW.C.8 and MN.C.1 gave 95 and 98% higher yield than group II and group III, respectively. The higher yield in the germplasm of group I, was mainly due to more branches and pods per plant, pod-length and seeds per pod, heavier seeds and maximum dry matter than the germplasm of group II and III and vice versa.

**Key words:** Cowpea, *Vigna unguiculata*, germplasm, yield components

### Introduction

Jatasra and Dahiya (1988) reported that forage yield was significantly and positively correlated with leaf weight, stem weight, plant height and branch number. Stem weight showed the highest direct effect on both green fodder and dry matter yields, followed by leaf weight. Choudhry *et al.* (1991) reported maximum heritability for dry matter and green fodder yield. Highly significant and positive correlation was noted for green fodder yield, crude protein, dry matter, leaf area and number of leaves/plant except for branches/plant which showed negative association. Thiyagarajan and Rajasekaran (1993) reported that the high yielding group consisted of 6 genotypes which were mostly medium to tall and had medium to high values for primary branches/plant, pods/plant, pod length, seeds/pod and 100-grain weight. Ellis *et al.* (1994) reported that in TVu1188, rate of progress towards flowering was affected by both temperature and photoperiod. Muhammad *et al.* (1994) reported that yield variation was mainly due to number of pods/plant and number of seeds/pod. Ram *et al.* (1994) found high heritability and high genetic advance for plant height, seed yield/plant and pods/plant. Seed yield was correlated with pods/plant, plant height and branches/plant. Sawant (1994) reported high phenotypic and genotypic coefficients of variation for plant height, seed yield/plant, pods/plant, inflorescence/plant and 100 seed weight. High heritability and high genetic advance was observed for plant height, seed yield/plant, pods/plant, 100-seed weight, inflorescence/plant, branches/plant and pod length. Seed yield was significantly and positively correlated with branches/plant and inflorescence/plant. Pods/plant had the highest positive direct effect on seed yield followed by 100-seed weight, seeds/pod, days to 50% flowering, inflorescence/plant, harvest index, plant height and pod length.

The objectives of this study were; to compare yield and yield components, to identify the desirable traits, to maintain and conserve the selected germplasm to prevent their possible extinction and to supply the selected germplasm to users for various research purposes.

### Materials and Methods

An experiment consisting of 20 germplasm of cowpea was planted on May 17, 1997 at the Research Farm of NWFP Agricultural University, Peshawar. Seed was originally collected from FATA (Federally Administered Tribal Areas) and neglected pockets of NWFP. For the sake of identification, accession numbers were assigned on the basis of the crop and their site of collection (Table A). The first portion of accession number designates the area from where the germplasm was collected,

Table A: List of cowpea germplasm under study

Acc. No	Acc. No
SW.C.31	SW.C.9
SW.C.8	SW.C.10
MN.C.1	D.C.11
CH.C.300	SW.C.301
WS.C.13	D.C.5
SW.C.25	SW.C.702
T.C.301	SW.C.404
SW.C.34	SW.C.101
SW.C.501	SW.C.15
SW.C.401	CH.C.302

Where

SW stands for Swat, CH for Chitral, D for Dir, MN for Mansehra, T for Tirah C stands for Cowpea

second portion designates the common name of the crop, while the number given at the end of each accession represents the series of germplasm of that crop collected within that particular area.

Each germplasm was considered as treatment and planted in randomized complete block design with three replications by assigning each individual germplasm to a plot of 6 m<sup>2</sup>. Each plot consisted of 4 rows, 3m long and 0.5m apart. Seedbed was prepared at proper vattar condition. A basal dose of 25 kg N and 64 kg P<sub>2</sub>O<sub>5</sub> per hectare was applied as DAP and incorporated into the soil during ploughing. Irrigation was applied when required. Weeds were controlled manually at the proper time.

Data were collected on days to first flowering, pod initiation, maturity, plant height (cm), branches and pods per plant, seeds per pod, pod length (cm), 100-seed weight (g), grain yield (kg/ha), dry matter yield (kg/ha) and harvest index (%). Data were analyzed statistically and means were compared using LSD test.

### Results and Discussion

It was very difficult to correlate the performance of individual germplasm in grain yield with other plant characters, therefore, the germplasm were first arranged in descending order and then divided into three groups on the basis of grain yield (kg/ha) to interpret meaningful results. Group I, consisted of 3 germplasm; two from Swat and one from Mansehra. Group II, consisted of 10 germplasm; seven from Swat and one each from Dir, Chitral and Tirah. Group III, consisted of 7 germplasm; five from Swat and one each from Dir and Chitral.

Flowering response was statistically different among germplasm (Table 1) with maximum of 103.0 days for SW.C.404 and

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**Table 1: Days to first flowering, pod initiation, maturity and plant height (cm) of cowpea germplasm**

Groups	Acc.No	Days to flowering	Days to pod initiation	Days to maturity	Plant height (cm)
I	SW.C.31	98.0 A-E	110.3 A	127.3 A	
	SW.C.8	96.0 B-E	109.0 AB	123.3 BCD	
	MN.C.1	86.3 F	93.7 C	118.0 FGH	
	MEAN GROUP I	93.4	104.3	122.8	382
II	CH.C.300	97.3 A-E	106.7 AB	117.3 GH	226 HI
	SW.C.13	93.7E	107.3 AB	119.7 FGH	228 HI
	SW.C.25	95.7 CDE	108.0 AB	125.3 AB	217 I
	T.C.301	97.3 A-E	107.0 AB	121.3 DE	231 HI
	SW.C.34	102.3 AB	109.3 AB	123.0 BCD	258 D-I
	SW.C.501	99.3 A-E	107.7 AB	119.3 EFG	265 H-D
	SW.C.401	98.7 A-E	109.3 AB	123.0 BCD	416 A
	SW.C.9	98.3 A-E	107.7 AB	118.0 FGH	287 CDE
	SW.C.10	102.0 ABC	109.7 A	121.0 DEF	281 D-G
	D.C.11	100.0 A-E	108.7 AB	123.7 BCD	244 F-I
	MEAN GROUP II	98.5	108.2	121.3	265
III	SW.C.301	95.3 DE	110.3 A	122.3 B-E	339 B
	D.C.5	94.7E	107.3 AB	119.3 EFG	249 E-I
	SW.C.702	94.0 E	105.0 B	115.7 H	242 GHI
	SW.C.404	103.0 A	109.3 AB	122.0 CDE	291 CD
	SW.C.101	94.7E	106.3 AB	115.7 H	286 DEF
	SW.C.15	101.3 A-D	110.7 A	120.7 DEF	349 B
	CH.C.302	99.7 A-E	109.7 A	121.3 DE	328 BC
	MEAN GROUP III	97.5	108.4	119.6	298
LSD at 5%	6.226	4.396	3.328	41.70	

Mean values in the same column carrying similar letters do not differ significantly at 5% level of probability using LSD test

**Table 2: Branches/plant, pods/plant, seeds/pod and pod length (cm) of cowpea germplasm**

Groups	Acc. No plant	Branches/ plant	Pods/ pod	Seeds/ (cm)	Pod length
I	SW.C.31	14.0 A	58.0 A	14.7 A	15.0 A
	SW.C.8	12.7 A	53.7 A	13.7 AB	14.3 AB
	MN.C.1	12.0 AB	23.7 B	6.0 CD	15.0 A
	MEAN GROUP I	12.9	45.2	12.5	14.7
II	CH.C.300	9.3 BC	5.0 CD	8.3 CD	8.3 EFG
	SW.C.13	7.7 CD	7.7 CD	7.3 D	9.3 CD
	SW.C.25	6.3 CD	6.3 CD	8.0 CD	8.7 CD
	T.C.301	7.3 CD	4.3 CD	9.0 CD	8.3 EFG
	SW.C.34	6.3 CD	5.3 CD	7.7 CD	9.7 D-G
	SW.C.501	8.0 CD	5.7 CD	7.7 CD	10.0 C-F
	SW.C.401	6.7 CD	6.7 CD	8.7 CD	10.7 CDE
	SW.C.9	7.0 CD	5.3 CD	10.7 BC	12.3 BC
	SW.C.10	5.7 D	4.3 CD	7.3 D	10.0 C-F
	D.C.11	7.0 CD	5.0 CD	8.3 CD	8.7 D-G
	MEAN GROUP II	7.2	5.6	8.3	9.7
III	SW.C.301	6.0 D	6.0 D	9.3 CD	9.7 D-G
	D.C.5	7.3 CD	7.3 CD	8.7 CD	10.3 C-F
	SW.C.702	7.3 CD	9.0 C	8.7 CD	8.0 FG
	SW.C.404	6.7 CD	4.7 CD	8.0 CD	8.3 EFG
	SW.C.101	6.0 D	5.0 CD	9.0 CD	7.3 G
	SW.C.15	6.7 CD	4.0 CD	8.7 CD	11.0 CD
	CH.C.302	7.0 CD	2.7 D	8.7 CD	8.3 EFG
	MEAN GROUP III	6.7	5.1	8.7	9.0
LSD 5%	3.177	6.156	3.018	2.594	

Mean values in the same column carrying similar letters do not differ significantly at 5% level of probability using LSD test.

minimum of 86.3 days for MN.C.1. Days to first flowering increased from 93.4 days in group I to 97.5 days in group III and then further increased to 98.5 days in group II.

Days to pod initiation varied significantly from 93.7 (MN.C.1) to 110.7 (SW.C.15) among germplasm (Table 1). Days to pod initiation increased from 104.3 days in group I to 108.2 days in

group II and then further increased to 108.4 days in group III. Response of cowpea germplasm was observed statistically significant towards maturity (Table 1) with maximum of 127.3 days for SW.C. 31 and minimum of 115.7 days each for SW.C.101 and SW.C.702. Days to maturity decreased from 122.8 in group I and 121.3 days in group II to 119.6 days in group III.

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Table 3: 100-seed weight (g), Grain Yield (kg/h), dry matter yield (kg/h) and harvest Index (%) of cowpea germplasm

Groups	Acc.No	100-seed weight (g)	Grain yield kg/ha	Dry matter yield kg/ha	Harvest index (%)
	SW.C.31	9.81 CD	2028.0 A	15560 A	13.09 A
	SW.C.8	10.33 C	1724.0 B	15280 A	11.32 B
	MN.C.1	13.09 A	544.3 C	12780 B	4.29 C
	MEAN GROUP I	11.10	1432.1	14540	9.56
II	CH.C.300	9.41 DEF	99.7 D	7222 C	1.38 DE
	SW.C.13	8.77 FGH	72.3 DE	4722 FG	1.56 D
	SW.C.25	7.76 I	70.7 DE	6722 CDE	1.06 D-H
	T.C.301	9.36 DEF	70.0 DE	6667 CDE	1.05 E-H
	SW.C.34	12.33	67.7 DE	5278 EFG	1.28 DEF
	SW.C.501	8.33 GHI	65.7 DE	5555 DEF	1.18 D-G
	SW.C.401	9.02 EFG	60.0 DE	6667 CDE	0.91 E-I
	SW.C.9	10.47 C	57.7 DE	6945 CD	0.83 F-I
	SW.C.10	12.03 B	55.0 DE	4445FG	1.26 DEF
	D.C.11	7.93 I	52.3 DE	5833 C-F	0.92 E-I
	MEAN GROUP II	9.54	67.1	6006	1.2
	SW.C.301	8.12 HI	41.0 DE	6667 CDE	0.65 HI
	D.C.5	9.52 DE	32.7 E	7222 C	0.46
	SW.C.702	5.94 J	30.0 E	5555 DEF	0.55
	SW.C.404	7.90 I	28.3 E	3889 G	0.75 GHI
	SW.C.101	8.07 HI	28.0 E	5555 DEF	0.51
	SW.C.15	9.29 DEF	26.7 E	5555 DEF	0.47
	CH.C.302	8.76 FGH	22.7 E	4444 FG	0.52
	MEAN GROUP III	8.23	30.0	5555	0.56
	LSD 5%	0.7186	63.90	1535	0.5014

Mean values in the same column carrying similar letters do not differ significantly at 5% level of probability using LSD test.

The difference in days to first flowering, pod initiation and maturity could be due to photoperiod, because different germplasm respond differently to a particular photoperiod. Ellis *et al.* (1994) reported that in some of the genotypes of cowpea the rate of progress towards flowering was by temperature and photoperiod. Early flowering, pod initiation and maturity indicate adaptability of germplasm in a new set of environment which might have resulted early termination of vegetative phase and initiation of reproductive phase in the prevailing favorable environment as compared to germplasm which took longer time to flowering, pod initiation and maturity indicating less adaptability in the prevailing environment. Plant height varied significantly among cowpea germplasm (Table 1) with maximum of 416 cm for SW.C.401, followed by 414 cm for SW.C.31 and minimum of 217 cm for SW.C.25. In the overall position, 2 germplasm produced a plant height between 414-416 cm, 5 germplasm between 328-370 cm and 13 germplasm between 217-291 cm. Plant height (cm) decreased from 382 cm in group I to 298 cm in group III and then further decreased to 265 cm in group II. As these germplasm were collected from different climatic conditions, so the rate of acclimatization of a germplasm may be considered the possible cause of this variation. Moreover, this variation in plant height could also be due to the genetic variability of different germplasm. High heritability and high genetic advance was reported for plant height by Sawant (1994) and Ram *et al.* (1994). Branches per plant varied significantly with maximum of 14.0 for SW.C.31 and minimum of 5.7 for SW.C.10 (Table 2). The average values decreased in descending order i.e. 12.9, 7.2 and 6.7 in group I, II and III, respectively. In general, 3 germplasm ranged between 12 and 14, 9 between 7 and 9.3, while 8 germplasm between 5.7 and 6.7 branches per plant. This variation in branches per plant could be due to plant type, Three germplasm (SW.C.31, SW.C.8 and MN.C.1) with spreading plant type produced more branches per plant (12-14), while 17 germplasm with semi-spreading plant type produced less number of branches per plant (5.7-9.3) in cowpea germplasm. As these germplasm

were collected from different climatic conditions, so the rate of acclimatization of a germplasm may also be considered the possible cause of this variation. Moreover, this variation might be due to the genetic variability of different germplasm. Sawant (1994) found high heritability and high genetic advance for branches per plant.

Pods per plant is an important yield component and contributes much towards final yield. Pods per plant varied significantly from 2.7 (CH.C.302) to 58 (SW.C.31) in cowpea germplasm (Table 2). Average values of pods per plant decreased in descending order i.e. 45.2, 5.6 and 5.1 in group I, II and III, respectively. This variation in branches per plant could be due to plant type. Three germplasm (SW.C.31, SW.C.8 and MN.C.1) with spreading plant type produced more number of pods per plant (23.7-58), while 17 germplasm with semi-spreading plant type produced less number of pods per plant (2.7-9) in cowpea germplasm. The rate of acclimatization of a germplasm may also be considered the possible cause of this variation. Moreover, this variation could be due to the genetic variability of different germplasm. Sawant (1994) and Ram *et al.* (1994) reported high heritability and high genetic advance for pods per plant.

Seeds per pod is also an important yield component. Maximum of 14.7 seeds per pod were recorded for SW.C.31, followed by SW.C.8 (13.7), while minimum of 7.3 seeds per pod were recorded for SW.C.10 (Table 2). Seeds per pod decreased from 12.5 in group I to 8.7 in group III and then further decreased to 8.3 in group II. In the overall position, 7 germplasm ranged between 9 and 14.7 and 13 germplasm between 7.3 and 8.7 seeds per pod. Genetic variability of germplasm might be responsible for this variation.

Variation in pod length of various cowpea germplasm was found statistically significant (Table 2). Germplasm SW.C.31 and MN.C.1 ranked first by producing longer pods of 15 cm each, while the shortest pods (7.3 cm) were noted for SW.C.101. Pod length decreased in descending order i.e. 14.7, 9.7 and 9 cm in group I, II and III, respectively. This variation could be due to the genetic

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variability of different germplasm.

Germplasm showed statistically significant differences in seed weight (Table 3) with maximum of 13.09 g for MN.C.1 and minimum of 5.94 g for SW.C.702. The weight of 100 seed decreased in descending order i.e. 11.10 g in group I to 9.54 g in group II and then further decreased to 8.23 g in group III. This variation could be due to the genetic variability of different germplasm.

Differences among the grain yield of cowpea germplasm were significant (Table 3). Germplasm SW.C.31 ranked first by producing maximum yield of 2028 kg/ha, while the second best was SW.C.8 with 1724 kg/ha. Minimum yield of 22.7 kg/ha was obtained by CH.C.302, followed by SW.C.15 with 26.7 kg/ha. The average values decreased in descending order i.e. 1432.1, 67.1 and 30 kg/ha in group I, II and III, respectively. This variation in branches per plant could be due to plant type. Three germplasm (SW.C.31, SW.C.8 and MN.C.1) with spreading plant type produced higher grain yield (544-2028 kg/ha), while 17 germplasm with semi-spreading plant type produced lower grain yield (22.7-99.7 kg/ha). Grain yield showed positive association with plant height, branches/plant, pods/plant, seeds/pod, pod length, 100-seed weight and dry matter. These results are in conformity with those of Thiyagarajan and Rajasekaran (1993), Muhammad *et al.* (1994), Sawant (1994) and Ram *et al.* (1994). All the germplasm showed statistically significant differences in dry matter yield (Table 3) with maximum (15560 kg/ha) and minimum (3889 kg/ha) for germplasm SW.C.31 and SW.C.404, respectively. Dry matter yield decreased in descending order i.e. 14540, 6006 and 5555 kg/ha in group I, II and III, respectively. Three germplasm (SW.C.31, SW.C.8 and MN.C.1) with spreading plant type produced higher dry matter yield (12780-15560 kg/ha), while 17 germplasm with semi-spreading plant type produced lower dry matter yield (3889-7222 kg/ha). Dry matter yield showed positive association with plant height and branches/plant.

Similar results were reported by Jatasra and Dahiya (1988). Moreover this variation might be due to the genetic variability of different germplasm. Choudhry *et al.* (1991) reported maximum heritability for dry matter yield.

Differences in harvest index were found statistically significant among cowpea germplasm with maximum of 13.09 for SW.C.31 and minimum of 0.46 for D.C.5 (Table 3). Harvest index decreased in descending order from 9.56 in group I to 1.2% in group II and then further decreased to 0.56% in group III. Harvest index (%) showed direct proportionality with grain yield (kg/ha).

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