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Determination of Selection Criterion for Maximization of Seed Yield in Chickpea (*Cicer arietinum* L.) under Rainfed and Irrigated Conditions (Research Note)

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ABSTRACT

A field experiment was conducted during winter 2001-2002 to construct suitable selection indices for obtaining high genetic gain for seed yield of chickpea for rainfed and irrigated conditions, separately. Selection indices clearly revealed that the number of effective pods per plant, seed yield and early flowering seem to be the most important traits for rainfed condition. Whereas the number of effective pods per plant, seed yield and days to maturity might be more rewarding for obtaining high relative efficiency under irrigated condition. Similar selection indices would be useful under rainfed and irrigated conditions. Early flowering provides longer span of reproductive phase under rainfed condition, while longer maturity period might be more responsive under irrigated conditions. Therefore, besides the high number of pods and seed yield, these component characters could also be considered while exercising selection under rainfed and irrigated conditions.

KEYWORDS: Chickpea, discriminant function, seed yield, selection indices.

1. INTRODUCTION

India is known to be the world's largest producer of chickpea contributing in 67% of the total area and 70% of corresponding production. Being the most important crop in India, it is grown in 6.25 million hectares with an annual production of 4.4 million tones. However, its productivity remains low (771 kg /ha) because of its cultivation in rainfed areas often facing the terminal drought. Undoubtedly, chickpea is being benefited by life saving irrigation but cultivar responsiveness is noticed for both moisture stress and non-stress (Saxena and Sheldarke, 1976). Hence, there is a need to develop high yielding cultivars suitable for rainfed and irrigated conditions, separately. To make it successful, a plant breeder has to develop an efficient selection scheme considering the various yield contributing traits. The present study was therefore, undertaken to determine a component based efficient selection approach for the maximization of seed yield of chickpea under rainfed and irrigated conditions.

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2. MATERIAL AND METHODS

The experimental material consisted of 26 genotypes of chickpea including Annegiri, ICC 4958 and JG 74 as standard checks. Field experiment was conducted during winter 2004-05 in a Randomized Completed Block Design (RCBD) with three replications under rainfed and irrigated conditions in two sets at Indira Gandhi Agricultural University, Raipur, India. Each genotype was accommodated in a five-row-plot of 4 m length with row-to-row and plant-to-plant spacing of 30 and 10 cm, respectively. The soil of the experimental site was vertisol having uniform topography, with pH 7.21 and water holding capacity of 37.86%. The basal application of fertilizer at 18 kg N, 46 kg P_2O_5 per ha in the form of Diamoniumphosphate was drilled by Dufan Nari plough followed by light planking to ensure proper seed germination. Irrigation was applied to the crop at 40 Days After Sowing (DAS) to one set of experiment for creating non-stress environment to crop. Two intercultural operations were carried out uniformly in both sets of experiments. To protect the crop from *H. armigera*, two sprays of insecticide monocrotophos 36 EC at 750 ml per ha were made at podding and grain filling stages. Five competitive plants were taken from each genotype for

recording observations on leaf size, plant height (cm), number of primary branches, number of secondary branches, height of first podding node (cm), number of pods, number of seeds per pod, harvest index (%), 100-seed weight (g) and seed yield per plant (g). Days to 50% flowering and maturity were recorded on plot basis. Data collected were subjected to statistical analysis and selection indices for rainfed and irrigated conditions were constructed separately (Smith, 1936).

3. RESULTS AND DISCUSSION

The analysis of variance for all the characters under rainfed and irrigated conditions, showed existence of considerable variability in the material studied. Considering the *per se* performance under rainfed and irrigated conditions, ICCV 98904 exhibited in built genetic potential for high seed yield per plant among all the genotypes under study Tables (1 and 2). Whereas ICCV 98903 showed the stable performance under stress and non- stress conditions. While genotypes ICCV 98907, 98936 and 98937 had shown substantial response to irrigation therefore, these can be successfully grown in protective irrigations. In general, there was an increase in seed mass and delay in maturity of a week due to supplementary irrigations.

Selection indices revealed that the expected genetic gain in straight selection (100 %) for seed yield was merely 2.88% while expected genetic gain was the highest in the number of pods per plant (34.38%) followed by 100-seed weight (15.98%) and days to 50% flowering (12.49%). These characters had also shown high Relative Efficiency (RE) over straight selection, indicating their significance for obtaining high genetic gain for seed yield under rainfed condition (Table 3).

The expected genetic gain over straight selection reached up to 123.01% when six characters *viz*., number of pods per plant, seed yield per plant, number of secondary branches per plant, number of seeds per pod, harvest index and days to 50% flowering were included in a discriminant function.

Relative efficiency of 111.52% was obtained for a two-character combination involving the number of pods per plant and days to 50% flowering. The combination of three factors involving the number of pods per plant, seed yield per plant and days to 50% flowering in the function showed genetic advance up to 116.58% over straight selection. Almost similar relative efficiency was noted in the case of five character combinations. The most effective and rewarding indices have relative efficiency up to 123.01% and were obtained in the combination of six characters *viz.,* pods, seed yield, secondary branches, seeds per pod, harvest index and days to flowering beyond which there was reduction in selection efficiency. Bhadouria *et al.* (2003) reported that primary branches per plant and pods per plant are the important factors on which selection could be practiced for the identification of high yielding genotypes of chickpea for the rainfed environment.

The inclusion of a less number of characters indicated high relative efficiency for seed yield while, it is vice-versa in case of complex selection scheme. High number of effective pods per plant, seed yield and early flowering seem to be the most important traits in the selection scheme for rainfed situation. Hence, while formulating the selection scheme for rainfed condition, these characters could be considered for high genetic gain towards seed yield.

The determination of selection indices for irrigated condition revealed that the expected genetic advance in straight selection (100 %) for seed yield was 4.42%. The maximum expected genetic advance in straight selection was observed for the number of pods per plant (33.25%) followed by 100-seed weight (16.37%) and days to 50% flowering (11.40%). These characters also exhibited high relative efficiency over straight selection, indicating their power of discrimination under irrigated condition (Table 3).

The expected genetic gain over straight selection reached up to 192.83% when all the traits under study were included in a discriminant function. Selection indices involving two components like days to maturity and number of pods per plant had shown the high relative efficiency of 164.58%. Selection indices involving three to five characters in function once again rewarded almost similar relative efficiency of 171.52 to 173.03%. The function may involve characters like the number of pods, seed yield and days to maturity under irrigated condition. The inclusion of six component characters *viz*., number of pods per plant, seed yield per plant, number of secondary branches per plant, number of seeds per pod, harvest index and days to maturity in function rewarded the better selection efficiency up to 179.00% against 192.83% as in case of all character combination. However, inclusion of more number of characters may create complications in the selection scheme. Hence, selection indices involving

three component characters would be more rewarding for enhancing the seed yield in chickpea under irrigated condition. Gumber *et al*. (2000) reported genetic gain up to 247.33% over straight selection by a combination of four characters involving secondary branches per plant, harvest index, pods per plant and seed yield in the function. On the other hand, the selection based on the yield components was also reported earlier by Yadav *et al.* (2002) for harvest index, 100 seed weight; Kumar *et al.* (2003) for pods per plant; Raval and Dobariya (2003) for harvest index; Raut *et al.* (2004) for secondary branches per plant, pods per plant, test weight; Srivastava *et al.* (2005) for plant height, secondary branches per plant, pods per plant, seeds per pod in chickpea.

Similar selection indices would be useful under rainfed and irrigated conditions except flowering and maturity. The most effective selection indices may include number of pods per plant, seed yield and days to 50% flowering for rainfed whereas the number of pods per plant, seed yield and days to maturity for irrigated condition for enhancing production. Early flowering providing longer span of reproductive phase seems to be desirable for rainfed condition while genotypes with longer maturity might be more responsive in irrigated condition. Hence, besides the high number of pods and seed yield, these component characters must be considered while exercising selection for better genotypes.

Table 1: *Per se* performance of different genotypes of chickpea under rainfed condition.

S. No.	Genotypes	1	2	3	4	5	6	7	8	9	10	11	12
1	ICCV 98901	33.33	3.50	42.93	2.36	5.06	20.93	84.66	34.37	1.60	48.70	18.86	9.16
2	ICCV 98902	33.66	3.56	41.90	2.40	5.26	20.46	84.66	25.00	1.60	48.39	29.96	7.66
3	ICCV 98903	38.66	3.60	49.50	2.23	5.46	23.40	85.00	37.60	1.47	51.41	27.16	12.40
4	ICCV 98904	39.66	3.33	45.40	2.00	4.80	21.00	87.33	53.60	1.40	53.81	25.11	15.63
5	ICCV 98905	38.00	3.66	41.43	2.80	5.73	19.50	85.33	41.43	1.33	61.09	19.70	12.93
6	ICCV 98906	40.00	4.30	42.46	2.60	5.90	20.83	83.33	35.57	1.53	54.18	28.08	11.36
7	ICCV 98907	38.00	4.46	45.40	2.36	5.13	21.96	84.33	57.13	1.00	51.96	28.16	11.10
8	ICCV 98908	42.66	3.66	42.90	2.40	5.36	20.50	88.66	58.30	1.60	54.38	14.50	14.06
9	ICCV 98911	37.33	4.53	41.66	2.40	5.63	21.66	84.00	67.60	1.27	51.83	10.50	11.83
10	ICCV 98912	37.33	3.80	43.26	2.60	5.96	21.56	86.33	61.73	1.47	56.29	12.83	11.80
11	ICCV 98916	33.66	4.53	50.23	1.80	4.46	26.33	75.66	74.93	1.20	53.90	10.33	10.20
12	ICCV 98926	33.66	3.30	42.16	2.40	5.53	21.60	81.66	69.60	1.80	50.69	9.33	11.53
13	ICCV 98928	39.33	3.46	40.80	2.60	6.43	21.60	85.66	71.60	1.40	51.35	9.00	10.06
14	ICCV 98933	36.00	3.20	42.33	2.80	6.70	21.43	82.66	81.53	1.47	64.30	9.33	11.93
15	ICCV 98936	44.66	3.60	49.43	3.03	6.46	25.46	93.33	62.60	1.27	56.33	10.00	10.50
16	ICCV 98937	39.66	4.43	42.43	3.20	6.80	21.80	93.33	64.60	1.87	49.35	8.83	9.80
17	ICCV 98939	47.00	3.53	40.10	3.20	7.00	21.20	83.66	68.00	1.60	52.34	10.16	12.10
18	ICCV 98947	40.33	4.30	48.06	3.13	6.70	24.86	82.66	72.93	1.33	54.13	8.83	10.73
19	ICCV 98916-4	37.66	3.36	42.10	2.96	6.26	21.46	88.66	32.13	1.20	51.48	28.50	7.70
20	ICCV 98916-8	48.66	3.50	47.40	3.00	7.13	24.73	96.00	38.53	1.67	58.61	27.83	9.73

S. No.	Genotypes	1	2	3	4	5	6	7	8	9	10	11	12
21	ICCV 98920-3	36.00	4.60	50.93	3.26	6.53	25.73	83.33	47.07	1.27	48.00	18.00	10.00
22	ICCV 98924-2	30.00	3.10	44.23	3.20	6.26	25.73	78.66	33.60	1.60	43.29	13.16	8.23
23	ICCV 98924-3	51.00	3.50	43.36	2.93	5.96	22.06	90.66	74.53	1.00	44.78	13.00	10.13
24	Annegeri (C)	41.00	3.06	43.50	3.46	6.93	23.10	85.00	39.93	1.27	60.11	27.33	10.40
25	ICC 4958 (C)	37.33	3.26	43.16	2.60	5.60	21.93	82.33	70.67	1.00	50.72	17.66	13.00
26	JG 74 (C)	59.66	3.60	46.46	3.00	5.93	24.13	87.33	61.60	1.07	49.35	16.30	10.66
	Mean	40.05	3.72	44.33	2.75	5.96	22.38	85.62	55.23	1.39	52.72	17.37	10.95
	CV%	2.40	3.95	3.27	7.12	4.46	3.36	1.07	1.48	9.60	4.12	2.68	11.02
	CD 5%	1.57	0.24	2.36	0.30	0.43	1.23	1.50	1.34	0.22	3.47	0.74	1.92

1. Days to 50% flowering
2. Leaf size (cm)
3. Plant height (cm)
4. Primary branches per plant
5. Secondary branches per plant
6. First pod bearing node
7. Days to maturity
8. Pod per plant
9. Seeds pod per plant
10. Harvest index (%)
11. 100 seed weight (g)
12. Seed yield per plant (g)

Table 2: *Per se* performance of different genotypes of chickpea under irrigated condition

S. No.	Genotypes	1	2	3	4	5	6	7	8	9	10	11	12
1	ICCV 98901	36.00	4.47	49.00	2.80	6.07	22.50	88.00	37.20	1.60	49.80	20.00	10.70
2	ICCV 98902	42.00	4.73	50.00	3.20	6.40	24.50	89.60	25.50	1.73	47.90	30.00	8.37
3	ICCV 98903	41.30	4.70	61.80	2.93	6.20	34.70	90.00	35.50	1.47	46.30	29.17	12.07
4	ICCV 98904	42.00	4.10	53.50	2.80	6.00	25.20	89.60	58.50	1.47	48.90	26.00	18.17
5	ICCV 98905	43.00	4.67	48.80	3.10	6.20	23.00	90.60	41.00	1.80	47.30	20.50	11.33
6	ICCV 98906	42.00	5.30	48.60	3.00	6.40	21.90	88.00	38.00	1.40	42.40	29.43	11.20
7	ICCV 98907	40.00	5.60	56.80	2.60	6.63	26.30	86.60	62.60	1.07	47.80	30.60	17.00
8	ICCV 98908	47.00	4.67	49.20	3.00	6.50	24.40	94.00	41.00	1.60	48.10	16.00	11.20
9	ICCV 98911	41.30	5.40	45.50	2.80	6.03	22.80	90.30	75.60	1.53	46.70	11.83	11.80
10	ICCV 98912	41.30	4.87	53.10	3.00	6.33	25.70	94.30	55.60	1.80	48.50	13.83	11.40
11	ICCV 98916	38.60	6.27	62.00	2.00	4.57	32.60	83.30	78.70	1.47	51.00	11.77	11.20
12	ICCV 98926	40.00	4.80	49.30	3.13	6.27	25.40	89.30	62.10	1.77	49.60	10.33	9.63
13	ICCV 98928	45.30	4.13	49.80	3.10	7.20	22.50	92.30	55.10	1.73	50.70	10.77	8.77
14	ICCV 98933	40.00	4.33	50.10	3.33	7.07	25.80	89.00	62.70	1.40	49.10	10.70	7.87
15	ICCV 98936	49.30	4.60	55.70	3.80	6.07	26.80	99.00	57.50	1.93	54.00	11.43	12.57
16	ICCV 98937	44.30	4.27	49.20	3.67	7.73	26.00	99.00	89.80	1.33	46.90	10.23	12.23
17	ICCV 98939	52.00	4.17	46.40	3.53	7.50	22.80	94.00	73.40	1.67	55.10	12.03	10.83

S. No.	Genotypes	1	2	3	4	5	6	7	8	9	10	11	12
18	ICCV 98947	43.00	5.23	57.90	3.40	6.83	29.00	89.00	67.70	1.87	50.60	10.50	9.43
19	ICCV 98916-4	43.00	4.27	44.00	3.27	6.53	22.80	98.00	34.40	1.40	46.10	30.13	8.80
20	ICCV 98916-8	53.60	4.50	52.00	3.67	7.53	25.40	102.00	42.70	1.73	54.50	30.23	11.67
21	ICCV 98920-3	39.30	5.07	51.80	3.27	6.67	25.70	88.60	41.60	1.47	48.30	19.27	8.07
22	ICCV 98924-2	38.00	4.20	52.00	3.53	7.00	24.70	83.60	35.40	1.73	50.80	14.73	8.57
23	ICCV 98924-3	53.00	4.60	46.60	3.27	7.07	23.50	95.00	70.10	1.00	45.20	14.40	9.80
24	Annegeri (C)	42.60	4.13	45.70	3.53	7.13	22.70	91.00	41.10	1.53	52.60	30.50	10.60
25	ICC 4958 (C)	41.00	4.30	50.00	3.23	6.47	24.80	89.30	62.50	1.00	56.40	18.33	11.43
26	JG 74 (C)	61.60	4.47	57.50	2.50	5.20	20.40	93.30	64.70	1.10	50.80	16.60	8.60
	Mean	43.88	4.72	51.40	3.13	6.52	25.13	91.40	54.20	1.52	49.40	18.82	10.89
	CV%	3.70	2.90	3.58	6.66	7.58	6.40	1.47	6.88	13.08	3.90	1.85	9.87
	CD 5%	2.65	0.22	3.01	0.34	0.81	2.63	2.21	6.11	0.32	3.15	0.57	1.74

1. Days to 50% flowering
2. Leaf size (cm)
3. Plant height (cm)
4. Primary branches per plant
5. Secondary branches per plant
6. First pod bearing node
7. Days to maturity
8. Pod per plant
9. Seeds per pod
10. Harvest index (%)
11. 100 seed weight (g)
12. Seed yield per plant (g)

Table 3. Discriminant function for seed yield and its components their expected genetic gain over straight selection in chickpea under rainfed and irrigated condition.

S. No.	Rainfed Condition		Discriminant function Y=	Irrigated Condition	
	Expected genetic advance	Expected gain (%) over strait selection		Expected genetic advance	Expected gain (%) over strait selection
1.	12.49	35.97	$b_1 x_1$	11.40	50.39
2.	0.95	2.73	$b_2 x_2$	1.05	4.64
3.	5.67	16.33	$b_3 x_3$	8.98	39.69
4.	0.79	2.29	$b_4 x_4$	0.70	3.09
5.	1.35	3.88	$b_5 x_5$	1.03	4.55
6.	3.33	9.59	$b_6 x_6$	5.58	24.66
7.	8.94	25.74	$b_7 x_7$	8.93	39.47
8.	34.38	99.02	$b_8 x_8$	33.25	146.99
9.	0.40	1.15	$b_9 x_9$	0.37	1.66
10.	8.72	25.11	$b_{10} x_{10}$	5.32	23.51
11.	15.98	46.02	$b_{11} x_{11}$	16.37	72.36
12.	2.88	100.00	$b_{12} x_{12}$	4.42	100.00
13.	38.82	111.52	$b_8 x_8 + b_1 x_1$	35.45	156.71
14.	34.57	99.56	$b_8 x_8 + b_2 x_2$	33.67	148.85
15.	34.90	100.51	$b_8 x_8 + b_3 x_3$	34.65	153.18
16.	34.28	98.73	$b_8 x_8 + b_4 x_4$	33.30	147.21

S. No.	Rainfed Condition		Discriminant function Y=	Irrigated Condition	
	Expected genetic advance	Expected gain (%) over strait selection		Expected genetic advance	Expected gain (%) over strait selection
17.	34.49	99.33	$b_8 x_8 + b_5 x_5$	33.40	147.65
18.	35.20	101.38	$b_8 x_8 + b_6 x_6$	33.25	155.83
19.	34.31	98.81	$b_8 x_8 + b_7 x_7$	37.23	164.58
20.	34.26	98.67	$b_8 x_8 + b_9 x_9$	33.34	147.39
21.	36.70	105.70	$b_8 x_8 + b_{10} x_{10}$	34.67	153.27
22.	24.01	69.15	$b_8 x_8 + b_{11} x_{11}$	29.17	128.95
23.	35.86	103.28	$b_8 x_8 + b_{12} x_{12}$	34.98	154.64
24.	40.28	116.01	$b_8 x_8 + b_{12} x_{12} + b_1 x_1$	36.94	163.30
25.	36.05	103.83	$b_8 x_8 + b_{12} x_{12} + b_2 x_2$	35.42	156.58
26.	36.32	104.60	$b_8 x_8 + b_{12} x_{12} + b_3 x_3$	36.55	161.58
27.	35.74	102.93	$b_8 x_8 + b_{12} x_{12} + b_4 x_4$	35.01	154.77
28.	35.93	103.48	$b_8 x_8 + b_{12} x_{12} + b_5 x_5$	35.10	155.17
29.	36.56	105.29	$b_8 x_8 + b_{12} x_{12} + b_6 x_6$	37.03	163.70
30	35.74	102.93	$b_8 x_8 + b_{12} x_{12} + b_7 x_7$	78.80	171.52
31.	35.75	102.96	$b_8 x_8 + b_{12} x_{12} + b_9 x_9$	35.06	154.99
32.	38.39	110.57	$b_8 x_8 + b_{12} x_{12} + b_{10} x_{10}$	36.20	160.03
33	25.89	74.56	$b_8 x_8 + b_{12} x_{12} + b_{11} x_{11}$	31.90	141.02
34.	40.48	116.58	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_1 x_1$	37.10	164.01
35.	36.11	104.00	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_2 x_2$	35.52	157.02
36.	36.37	104.75	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_3 x_3$	36.64	161.53
37.	35.84	103.22	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_4 x_4$	35.13	155.30
38.	36.66	105.58	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_6 x_6$	37.12	164.10
39.	35.95	103.54	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_7 x_7$	39.05	172.63
40.	35.82	103.16	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9$	35.19	155.57
41.	38.54	111.00	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_{10} x_{10}$	36.34	160.65
42.	25.82	74.36	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_{11} x_{11}$	32.04	141.64
43.	40.34	116.18	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_1 x_1$	37.17	164.32
44.	36.00	103.68	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_2 x_2$	35.60	157.38
45.	36.25	104.40	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_3 x_3$	36.64	161.98
46.	35.73	102.90	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_4 x_4$	35.22	155.70
47.	36.54	105.24	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_6 x_6$	37.22	164.54
48.	35.86	103.28	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_7 x_7$	39.14	173.03
49.	38.43	110.68	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10}$	36.45	161.14
50.	25.63	73.81	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{11} x_{11}$	32.07	141.77
51.	42.71	123.01	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_1 x_1$	38.90	171.97
52.	38.57	111.08	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_2 x_2$	36.81	162.73
53.	38.79	111.72	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_3 x_3$	37.97	167.86
54.	38.38	110.54	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_4 x_4$	36.53	161.49
55.	39.05	112.47	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_6 x_6$	38.43	169.89
56.	38.78	111.69	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_7 x_7$	40.49	179.00
57.	29.57	85.16	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_{11} x_{11}$	32.72	144.65
58.	35.01	100.83	$b_8 x_8 + b_{12} x_{12} + b_5 x_{5+} b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_1 x_1$	35.01	157.77

S. No.	Rainfed Condition		Discriminant function Y=	Irrigated Condition	
	Expected genetic advance	Expected gain (%) over strait selection		Expected genetic advance	Expected gain (%) over strait selection
59.	29.68	85.48	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2$	33.06	146.15
60.	30.23	87.06	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_3 x_3$	34.24	151.37
61.	29.47	84.87	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_4 x_4$	32.78	144.91
62.	30.05	86.54	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_6 x_6$	34.75	153.62
63.	30.93	89.08	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_7 x_7$	37.20	164.45
64.	35.06	100.97	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_1 x_1$	35.23	155.74
65.	30.40	87.55	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_3 x_3$	34.67	153.27
66.	29.57	85.16	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_4 x_4$	33.10	146.33
67.	30.19	86.95	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_6 x_6$	35.15	155.39
68.	31.00	89.28	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_7 x_7$	37.40	165.34
69.	35.83	103.19	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_3 x_3 + b_1 x_1$	36.79	162.64
70.	30.27	87.18	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_3 x_3 + b_4 x_4$	34.24	151.37
71.	31.64	91.12	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_3 x_3 + b_7 x_7$	38.16	168.70
72.	39.79	114.60	$b_8 x_8 + b_{12} x_{12} + b_5 x_5 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + b_2 x_2 + b_3 x_3 + b_7 x_7 + b_1 x_1 + b_6 x_6 + b_4 x_4$	43.62	192.83

x_1= Days to 50% flowering, x_2= Leaf size, x_3= Plant height (cm),
x_4= Number of primary branches per plant, x_5= Number of secondary branches per plant, x_6= First pod bearing node (cm),
x_7 =Days to maturity , x_8= Number of pods per plant, x_9= Number of seeds per pod,
x_{10}= Harvest index (%), x_{11}= 100-seed weight (g), x_{12}= Seed yield/ per plant (g)

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تحديد معيار اختيار لزيادة محصول الحمص (*Cicer arietinum* L.) في ظل ظروف الزراعة البعلية والزراعة المروية (ملحوظة علميـة)

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ملخـص

تم تنفيذ تجربة حقلية في شتاء 2001-2002 من أجل بناء مؤشرات اختيار مناسبة بهدف الحصول على استفادة جينية عالية فيما يتعلق بحاصل البذور في ظل ظروف الزراعة البعلية والزراعة المروية بشكل منفصل.

لقد بينت مؤشرات الاختيار بوضوح أن عدد القرون الفعالة في كل نبتة، وحاصل البذور، والتزهير المبكر هي أهم الميزات في ظل الري بالأمطار، بينما كان عدد القرون الفعالة في كل نبتة، وحاصل البذور، وفترة النضوج أهم الميزات فيما يتعلق بالحصول على فاعلية في ظل الزراعة المروية.

وقد تكون مؤشرات متشابهة مفيدة في ظل الزراعة البعلية والزراعة المروية. إن التزهير المبكر يوفر فترة أطول لمرحلة إعادة الإنتاج في ظل الري بالأمطار؛ بينما قد تكون فترة نضوج أطول أكثر استجابة في ظل ظروف الزراعة المروية. لذا، فإنه الى جانب عدد القرون لكل نبتة، وحاصل البذور، يمكن أخذ هذه الخصائص في الاعتبار عند ممارسة الاختيار في كل من الزراعة البعلية والزراعة المروية.

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