



## General and specific combining ability and backcrosses for grain yield and its components in beans plant (*Vicia faba* L.)

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### Abstract

In this study, six genotypes of faba beans (*Vicia faba* L.) were used: 3-FLIP11-088FB, 4-FLIP11-092FB, 5-Line46-01, 6-France, 2-FLIP06-005FB, and 3-FLIP06-016FB. During the 2023/2024 growing season, the first prototype for the first-generation hybrids, consisting of 30 individual hybrids, was included in the Full Diallel Crosses program using the initial Griffing (1956) [14] method. At the Field Crops Department's research station, genetic structures (parents and first-generation hybrids) were planted in an experiment using a complete randomized sector design with three replicates.

Mosul University's College of science during the 2023–2024 growing season, in order to assess the performance of fathers and their crossings and produce monohybrids that perform differently in the field. Additionally, the productivity where the outcomes were displayed. While the general combining ability to specific varieties was significantly different at the level of 1% and 5% for all studied traits except for the height of the plant, the number of total branches, the number of nodes, and the weight of a hundred grains, genetic variations showed a significant difference for all traits except for the characteristics of the number of nodes, the number of florets, and the weight of a hundred grains.

the weight of one hundred grains, the harvest index, and the weight of pods. Regarding the specific combining ability, the camel differed significantly in every characteristic except the weight of one hundred grains, the percentage of the contract, and the quantity of flowrets.

**Keywords:** Beans, genetic differences, specific and general combining ability

### Introduction

The faba bean (*Vicia faba* L.) (n = 12) is a member of the renowned Fabaceae family and is regarded as one of the most significant and essential nutritional legumes crops due to its high protein content (28–32%) and useful and necessary substances for humans from proteins, vitamins, and other nutritional elements (Moschini *et al.*, 2005) [24] and (Diaz *et al.*, 2006) [11]. It is cultivated using a variety of rotations, mostly with cereals but also increasingly with intercrops (Abou-khater *et al* 2024) [1], (Maalouf *et al* 2019) [19]. Although dried faba beans are planted on every continent, their global production area has shrunk from 5.5 million hectares in 1960 to 2.78 million hectares in 2023 (FAO, 2024).

The seeds of the faba bean (*Vicia faba*), a cool-season legume grown all over the world, are known for having a high protein and fiber content and a low-fat level (Martineau-cote *et al* 2024) [20]. The species has historically classified as var. minor (40 g per 100 seed), var. equina (40–80 g per 100 seed), and var. major (>80 g per 100 seed) based on the size of the seeds (Maalouf *et al* 2019) [19]. While major varieties are harvested as fresh or dried seeds or pods for human consumption with a variety of culinary purposes, minor and equina varieties are primarily used as ripe, dry seeds for food or feed (Pasquolone 2020).

According to (Pluduma, 2018) [27], this makes this crop a necessary nutritional requirement to offset the high expense of animal protein. It is thought that peas originated in the Middle East and then moved to Europe, North Africa, and

Central Asia (Matthews and Marcellos, 2003) [22]. One of the biggest producers and consumers is China. The significance of beans, which are followed by Ethiopia (Gurmu *et al.*, 2012) [15], lies in the fact that it is used as a staple food for people due to its vital nutrients and seeds (Gnanasambandam *et al.*, 2012) [13].

beans yield 18, 3 million tons of seeds and cover 24.5 million hectares of land (FAO, 2004). In Iraq, 14.4 thousand tons of agricultural production were produced on 20.4 thousand hectares of cultivated land (Agricultural Economics Research Department, 2012) [2]. Where peas are considered one of the most important crops rich in protein, starch, cellulose and minerals (haci seferogullari and others 2003) [17], as well as their entry as a human breakfast and food for animals, especially for horses, poultry and pigeons, particularly in Mediterranean nations like China and Ethiopia, where winter is the ideal time of year for peas, but the high temperatures cause them to ripen early (Lidmann Gloyer, 2003). Peas have been an answer to Saudi Arabia's production issues since the early 1990. Complete cross-hybrids are defined by (Mather and Jinks, 1974) [21] as a collection of potential interbreeding between (P) of parents that result in (P2) from unions. This strategy is used to gather genetic information following one generation of crossbreeding, and it includes self-pollination, which is one of the finest ways to obtain genetic information about the group of strains or varieties to be tested in the initial generations.

Plant breeders gain from the introduction of suitable techniques. The breeders of plants are attempting to improve

the quality of the seed yield in various unrated ways in order to obtain new inputs to obtain genes and in the desired direction to improve the yield in terms of quantity and quality. They are also following the steps to enter new inputs that are compared with the local comparative variety in order to benefit from it in different breeding programs. a study to enhance its related qualities, and by Examining the factors that contribute to the fact that the seed is one of the most significant quantitative qualities that many hereditary genes have inherited, because of the significant influence of the environment on them, and because they are the outcome of several related traits( Al-Shakraji ,1999) and (Al-Hamdani ,2013) [5] received The genotypes of numerous variables, including flowering date, number of seeds per pod, seed production, and weight of 100 seeds, differed significantly when the five leguminous species varieties were crossed. Additionally, (Ozlem, A., and Hakan, 2007) [16, 29] found that there were notable variations in plant height features among the genotypes of five pea varieties, weight of 100 grains, number of seeds per pod, number of branching features of plant height, and seed yield. According to a genetic analysis of 24 pea genotypes, there are notable variations between them in terms of the plant aggregation formula (Pritam, K. and S. Shivani, 2004) [28]. In a study involving six pea varieties, (Nadal *et al.* 2005) [25] noted that there were notable variations among the following traits: When examining six distinct pea genotypes for the traits of branch count and yield, (Alghamdi, 2007) [10] explains the following: blooming date, plant height, number of branches, number of seeds per pod, and seed yield. The weight of 100 grains, the seed holder, and the biology (Abuanja and Abdelmula, 2007) [8] evaluated five different pea varieties to find significant differences between the genotypes of the traits: plant height and number of branches, and the number of seeds per pod, seed yield, and weight of 100 grains. These findings demonstrated significant differences in the characteristics of the number of seeds/pod and the weight of one hundred grains, as explained by (Hakan Ozlem 2007) [16, 29]. According to a study that comprised 25 different pea genotypes, (found that the genotypes differed in terms of flowering date, plant height, and branch count. weight of one hundred seeds, number of seeds per pod, and seed output. (Al-Shukergi ,2010) arrived at the moral distinctions between the traits of the quantity of seeds. I observed a significant genetic and phenotypic variance in the height of the plant and the biological yield in the pod and the weight of 100 seeds. After examining the four kinds, I came to the conclusion that the biology and mean yield of the weight of a hundred seeds demonstrated high genetic improvement values for the plant's branch features (Askender,2011). The peasants' traits of blooming days, plant height, number of seeds/pods, seed production, and weight of 100 seeds were all significantly impacted by genetic diversity. (yousif, A.I. and MKalquma,2012) [32] found that there was a substantial difference in the number of attributes across the six pea genotypes evaluated. In a study of four pea varieties, (Abbas, 2012) [6] explained the days of flowering, plant height, and biological yield. The study found that there were significant differences in height between genotypes, as well as in the number of seeds per pod, the weight of one hundred grains, and the biological and seed yields. In terms of numbers, the phenotypic

difference coefficient was considerable. The number of seeds or pods and the branches of the plant. The plant's objective, the quantity of branches, the quantity of seeds, the yield of seeds, and the weight of one hundred seeds as a comparison (Mulualem *et al.* 2013) [23]

An estimate of genetic and phenotypic variation as well as expected genetic improvement for characteristics are shown in a study of ten genotypes that shows significant differences between them in the characteristics of number of flowering days, plant height, biological yield, and seed yield.

### Conclusions

This study indicated phenotypic and genotypic genetic variation estimate and the expected Genetic improvement for the yield characters and it component to choose the best characters in the early Generation and the allow generation for it and the effect of determination of gene in the seed Yield to continue in the future breeding programs and the influential definition it the effect of Seed yield and significant effect level for the positive and negative range from different transactions was Clear from the first generation with wide and clear in the local variable transaction. The values of Significant level effects at the 1% and 5 %probability level are positive significant from Most of the studied quantitative characteristics, the ratio of the components of the variance of the General combining ability to the special combining ability is less than from the Main of traits except the days of flowering; and this study indicated the important of the extra Genetic action in the inheriting of these traits.

### Material and methods

The sequence, names, and proportions of the six Faba Bean genotypes utilized in this investigation are displayed in table (1). These genotypes were received from ICARDA and included the biology department of the College of science at the University of Mosul, the seeds of the six fathers were sown on November 25, 2023. When the plants started to flower, they were put into full cross-exchange crosses to produce the first 30 hybrid seeds of the first 30 hybrids using the first method. Using the design of complete random sectors (RCBD) with three repeats, the seeds of the six fathers and all hybrids were planted in the same field on November 20, 2023, according to the first model of (Griffing, 1956) [14]. One repeater had 36 lines, each measuring two meters in length, with a 30-cm gap between lines.

between another 25 centimeters and Jura. As advised by (Wanted and others 1989) [31], agricultural service activities included irrigation, weeding, thinning, and uniformly regulating all treatments. Additionally, it gave the plant 150 kg of N.P. (27:27) compost fertilizer per hectare in two batches, the first occurring 45 days after cultivation and the second occurring a month later (Abdalla and Wahab, 1995) [7].

Six genotypes of Faba Bean were selected for this study: FLIP06-005FB-, FLIP06-016FB 2-and FLIP11-088FB3-, FLIP11-092FB 4-and Line46-015 and France6- obtained from ICARDA, and the table (1) shows the sequence, names and proportions of the genotypes used in the study.

**Table 1:** Numbers, names and pedigree from the einteres.

Pedigree	Name genotype	No.
DT//B7//7380//0405-HBP/ES0/2000	FLIP06-005FB	1-
DT//B7//7428-2//0405-HBP/DS0/2000	FLIP06-016FB	2-
F7//7204//05-HBP/S0D/2000	FLIP11-088FB	3-
F7//7789-2//05-HBP/S0D/2000	FLIP11-092FB	4-
HBP//S0E//99	Line46-01	5-
Local check	France	6-

**Table 2:** Analysis of variance of general and specific combining ability and backcrosses according to the method (Griffing 1956) <sup>[14]</sup>, the first model for fifteen traits.

studied charecteres															variance source v.s
Weight of 100 seeds. (g)	Harvest index (%)	Grain yield. (gmlplant)	Biological yield. (gm/plant)	Weight of pods.	Ratio of knods.	Number of florets.	Number of nodes.	Number of seeds per pod.	Pod length.	Number of total pods.	Number of pods on the main stem.	Number of total branches of the plant.	Plant height. (cm)	Number of days to flowering at 50%.	
187.198	2.369	33442.338	201.670	2256.554	21.906	1.674	7.702	0.029	4.944	25.860	6.952	2.924	45.1	4.925	replicated
773.31 0n.s.	29.706**	21431.2 4**	432.852**	1617.641**	58.662**	0.91 1n.s.	9.32 3n.s.	0.82 5**	13.46 1**	83.70 1**	14.02 3**	1.60 2*	161.694**	26.958**	the parent & hybrids
1027.005n.s.	18.018n.s.	37487.25**	486.018**	1065.166n.s.	159.16**	1.32*	18.662n.s.	1.255**	33.1 7**	248.12 3**	53.15 1**	0.34 0n.s.	42.73 1n.s.	80.720**	The general combining ability G.C.A.
841.43 1n.s.	28.061**	20672.529**	485.033**	1951.99**	58.434n.s.	0.905n.s.	10.422*	0.530*	8.811**	83.630**	11.305**	2.38 1**	127.636**	14.737**	The specific combining ability S.C.A.
620.624n.s.	35.247**	16837.944n.s.	362.951**	1468.336**	25.392n.s.	0.77 7n.s.	5.112n.s.	0.977**	11.542**	28.966**	3.699**	1.243n.s.	235.402**	21.277**	back crosses
581.841	11.625	7683.162	135.201	575.388	26.012	0.570	5.855	0.303	2.602	17.651	3.219	0.887	45.008	4.506	experimental error
-9.766	0.022	-18.255	-6.130	-35.047	-0.223	-0.003	-0.137	0.021	0.354	-0.284	0.184	-0.073	2.341	0.963	The component of variance G.C.A. The component of variance S.C.A.

**Table 3:** Estimates of the effect of the general combining ability for each parent for fifteen characteristics

The studied charecteres															The parents
Weight of 100 seeds. (g)	Harvest index (%)	Grain yield. (gmlplant)	Biological yield. (gm/plant)	Weight of pods.	Ratio of knods. %	Number of florets.	Number of nodes.	Number of seeds per pod.	Pod length. (cm)	Number of total pods.	Number of pods on the main stem.	Number of total branches of the plant.	High plant) (cm)	Number of days to flowering at 50%	
1.098	1.281	-10.205	2.226	-1.236	1.833	0.184	0.649	-0.082	-0.755	2.14	1.434	0.092	1.564	-2.462	<b>1</b>
-4.246	-0.446	-29.921	-4.553	-2.041	0.281	-0.288	0.092	0.112	-0.424	0.332	-0.397	-0.156	-1.45	0.482	<b>2</b>
-4.581	-0.699	32.773	1.877	5.721	0.445	-0.01	-0.212	-0.277	-0.727	1.055	0.240	0.066	-0.170	-0.961	<b>3</b>
1.690	-0.337	43.878	4.570	7.607	1.300	0.240	0.76	0.001	0.224	2.279	1.240	0.066	0.967	0.730	<b>4</b>
-3.36	-0.046	-1.817	0.045	-5.766	0.230	-0.064	-1.240	-0.029	-0.123	-1.082	-0.814	0.008	-0.504	1.814	<b>5</b>
9.397	0.247	-34.705	-4.17	-4.283	-4.09	-0.064	-0.045	0.279	1.805	-4.721	-1.703	-0.073	-0.406	0.397	<b>6</b>

**Table 4:** Estimates of the effect of the special combining ability for each hybrid for fifteen traits

The studied characters															(The hybrid)
(Weight of 100 seeds. (g))	(Harvest index (%))	(Grain yield. (gmlplant))	(Biological yield. (gm/plant))	(Weight of pods.)	(Ratio of knods. %)	(Number of florets.)	(Number of nodes.)	(Number of seeds per pod.)	(Pod length. (cm))	(Number of total pods.)	(Number of pods on the main stem.)	(Number of total branches of the plant.)	(High plant) (cm)	(Number of days to flowering at 50%)	

-0.723	-2.481	54.282	0.008	1.64	4.657	0.066	-1.732	-0.112	-0.385	0.332	0.760	0.184	0.045	-3.453	2×1
-2.391	-0.706	-75.914	-9.35	-19.201	-0.741	-0.381	0.073	0.279	1.001	-4.89	-1.045	-0.203	-6.897	0.990	3×1
7.511	-0.370	44.650	2.826	10.24	1.271	-0.295	0.27	-0.166	-1.152	1.39	0.121	-0.203	1.795	-0.536	4×1
-0.461	1.643	15.345	7.787	2.757	0.737	0.177	-0.567	-0.14	0.895	4.416	0.842	0.52	1.77	1.212	5×1
-11.913	-2.70	-5.431	-5.550	-13.741	-1.496	-0.156	-0.594	0.055	-0.701	-0.943	-1.27	0.101	-0.08	0.962	6×1
-2.361	0.430	-57.815	-4.513	-15.604	-2.771	-0.240	-1.538	0.082	0.085	-5.082	-1.881	-0.786	-3.550	1.881	3×2
-6.088	0.671	-35.634	-1.305	-3.221	-5.529	0.342	1.825	-0.195	0.101	-1.64	-1.045	0.545	0.811	0.184	4×2
9.041	0.568	-22.440	-2.75	2.361	0.305	-0.351	1.490	0.001	-0.052	-0.443	0.008	-0.897	-1.219	-0.897	5×2
0.132	0.935	-71.551	-6.173	-27.636	-1.581	-0.353	-0.371	0.195	-1.363	-2.805	-0.77	-0.814	-8.15	-0.314	6×2
-21.770	-2.257	-59.997	-13.911	-11.481	-0.090	-0.103	0.464	-0.14	-1.563	0.805	-0.02	-0.342	-1.300	-2.203	4×3
12.813	1.634	37.366	10.301	18.686	0.740	0.038	-0.703	0.557	1.532	0.501	-0.131	0.381	3.670	1.045	5×3
8.991	2.566	41.921	13.235	23.051	0.524	0.705	-0.566	-0.582	-0.643	1.14	0.76	0.962	1.908	0.462	6×3
-6.588	-1.69	29.595	-3.104	-13.615	-2.065	0.621	-2.342	0.277	0.663	-3.555	-0.962	-0.121	1.20	1.184	5×4
23.272	0.706	-34.181	-4.871	-9.140	-2.107	-0.381	0.131	0.305	2.235	-2.751	-1.406	-0.203	-3.064	0.601	6×4
2.515	1.883	3.18	2.543	-1.113	1.629	-0.242	1.131	0.000	-1.051	0.945	1.147	-0.314	1.073	-1.147	6×5
8.37	1.184	30.412	4.035	8.323	1.771	0.263	0.841	0.192	0.561	1.459	0.622	0.326	3.229	0.736	S. E

**Table 5:** Estimation of the inverse effects of fifteen traits

Weight of 100 seeds. (g)	the studied characters														Back crosses
	Harvest index (%)	Grain yield. (g/mlplant)	Biological yield. (gm/plant)	Weight of pods.	Ratio of knods. %	Number of florets.	Number of nodes.	Number of seeds per pod.	Pod length. (cm)	Number of total pods.	Number of pods on the main stem.	Number of total branches of the plant.	High plant) cm)	Number of days to flowering at 50%	
5.031	1.700	-7.501	3.486	-4.34	-2.451	-0.332	1.501	-0.668	-0.332	-0.165	-0.334	0.334	1.334	-1.001	1×2
2.786	1.294	46.668	7.658	4.132	1.3	-0.166	-0.334	0.334	0.916	-0.666	0.168	0.501	3.001	4.002	1×3
-3.867	-0.541	48.334	2.200	13.697	1.28	0.168	1.832	-0.501	0.051	6.166	2.334	0.502	10.501	4.166	1×4
9.652	3.991	13.332	12.874	14.806	-0.56	0.000	-0.334	0.168	1.918	0.501	-0.668	-0.501	10.000	0.000	1×5
26.274	1.80	52.332	8.714	8.967	-0.924	0.332	0.166	0.332	2.751	-0.168	0.000	0.668	10.082	1.332	1×6
-2.341	0.251	-83.281	-9.112	-23.665	-1.65	0.168	-0.502	0.000	0.000	-3.668	-0.501	0.000	-8.668	-2.501	2×3
-15.953	-2.255	-45.002	-10.656	-30.270	0.355	0.334	0.166	0.000	0.034	-2.001	0.668	-0.334	-0.168	1.501	2×4
17.119	4.281	-29.165	5.281	1.536	3.236	-0.332	-0.501	-0.168	-0.634	-1.168	0.334	-0.168	4.001	0.501	2×5
6.306	1.311	-18.835	-0.838	-0.651	-1.930	0.334	0.165	1.002	1.918	-1.168	-0.332	-0.501	4.502	-1.001	2×6
-7.032	0.914	-46.668	-2.361	-26.050	4.189	-0.501	-0.165	0.334	-0.832	-0.166	0.668	-0.334	-3.001	-1.668	3×4
-3.924	0.347	75.001	11.083	22.404	2.715	-0.334	1.335	0.334	2.416	3.501	0.832	0.334	5.834	0.334	3×5
7.817	1.050	90.001	13.941	20.531	-1.471	0.332	1.001	0.168	0.666	0.166	0.168	0.834	3.166	1.668	3×6
-0.776	-0.732	11.668	-0.282	0.894	-3.002	0.834	1.334	0.334	1.168	-0.668	0.668	0.168	7.168	-0.168	4×5
0.754	4.671	-55.001	6.211	-2.68	0.684	0.166	-1.332	0.000	-1.168	0.168	0.000	-0.666	-1.001	1.166	4×6
-0.224	3.810	-73.334	-1.875	-7.637	0.892	0.332	0.000	-0.332	-1.701	0.834	0.834	-0.168	7.002	-0.501	5×6
9.847	1.391	35.783	4.748	9.792	2.080	0.31	0.987	0.226	0.66	1.716	0.732	0.386	2.74	0.868	S.E

## The results

Table [2] show the variation of analysis from the specific and genetic combining ability and back crosses hybrids according Griffing 1st method by for fifteen characters and the effect of the estimate general combining ability for each parent and specific combining ability to each hybrid and back crosses hybrids effect according the following equation (Singh and Chadahury 1979) [30]. The effect of General combining ability for parent  $g = Y_2n(y_i + y_j) - 1/n^2$  specific combining ability for hybrids  $1/2(y_i + y_j + y_j + y_i) + 1/n^2 y_i y_j = 1/2(y_{ij} + y_{ji}) - r^2$  (effect of each hybrid) the effects were tested by the equit able equities. Also Table [2] express the different significant effect in the probability level (5%, 1%) from : flowering days number in 50%, plant high (cm), total pods number; pod high, seed number of pod, podweight; biological yield {gm/plant } and harvest index (%). The component ratio variation general combining ability component to specific combining ability component more of one for the plant high (cm) (Abbas 2012) [7], (Lindmann 2003) [18]. It means the important non additive genetic effects in genetic study status. Comparison between another status it is (zero) less of (one). It means more effect to an additive gene effect to express it. According to the Griffing technique, the first model for fifteen qualities, Table [3] displays the study of the variance of the general combining ability, the special federal ability, and reverse hybridization. The following equations were used to estimate the effects of each father's general federal ability, each hybrid's unique federal ability, and the opposing effects of hybrids (Singh and Chaudhary, 1979) [30].

The impact of each person's overall federal ability Table [3] demonstrated that the level of likelihood (1% and 5%) was significantly impacted negatively. percentage of 50% flowering days, the height of the poisoned plant, the number of pods overall, their length, the number of seeds within each pod, their weight, the vital yield (g/plant), and the harvest index (%) With the exception of the trait of plant height (in poison), the ratio of the components of the variance of the general federal ability to the components of the variation of the private federal ability was less than the correct one. This suggests that non-additional genetic influences play a larger role in expressing these traits than do additional genetic influences in inheriting them.

An estimate of the impact of the federal capacity is provided in Table [4]. The general federal ability to express the performance rate of parents in hybrid structures is expressed by the fifteen quantified qualities that each father possesses. The effect of each father's general federal ability was estimated using the equation provided by Griffing (1965) [14] and the first method that allows for the estimation of the effect of the special federal ability. In crossbreeding and selection programs, the number of flowering days had positive values for the father [4], allowing for the diagnosis of beneficial parental varieties for each hybrid. as well as the father [5], the father [6], and in the direction that is intended. The pulp [1] and the father [4] had positive values in the intended direction with regard to the plant's height. Regarding the overall quantity of branches, for this attribute, the pulp [1], the father [3], the father [4], and the father [5] have favorable and desired values. The pulp [1] and the father [4] have positive values and are in the ideal direction for the adjective number of pods on the main stem. Both the father [4] and the pulp [1] were positive and moving in the right direction. Regarding the pod's adjective length, the pulp [6]

was a favorable and appealing value. The father [2] and the father [6] were responsible for this characteristic and the quantity of seeds in the pod. [1] Both the father [1] and the father [4] have positive and desired values for the adjective number of florets, and the father [4] has good and desirable values for this attribute. Regarding the contract's adjective %, it applied to the father [1] and the father [4] cast. The pulp [1], [3], and [4] had the vital outcome, while the pulp [3] and [4] had the positive and desired values for this descriptor and the weight of the pods.

The pulp had a grain yield of [3], while the father had a grain yield of [4]. These were both positive and desired results. Regarding the harvest guide's attribute, the pulp [1] had a desirable and positive value for both the weight of a hundred grains and this trait. There was a positive and desirable value for the pulp [6].

According to the equation and the first method of Griffing (1956b) [14], Table [5] displays the estimates of the effect of the special federal ability for each hybrid for fifteen traits. The crosses showed a difference with respect to the number of flowering days, where the crosses showed (1 × 5), (2 × 3), (5 × 3), and (5 × 4) desirable and high value for this feature, as demonstrated by crossings in the plant height (cm) characteristics of 4 × 1, 5 × 1, 5 × 3, 6 × 3, and 5 × 4. Additionally, the hybrids (5 × 1) and (4 × 2) had positive and desirable values for the trait of the total number of plant branches, and the hybrids (2 × 1), (4 × 1), and (6 × 3) had positive and desirable values for the number of pods attribute on the main stem. These hybrids also had a desired and positive value for the trait of the number of branches. The hybrids had positive values for the descriptor "total number of pods" (4 × 1), "5 × 1), and "6 × 3) and were desired for this attribute. Regarding the pod's adjective length, the hybrid for the number of seed traits, hybrids (1 × 3) and (5 × 3) and (6 × 1) emerged, whereas (3 × 1), 5 × 4, and (6 × 4) were favorable and desirable for this feature. In the Qurna, this quality was regarded as favorable and desirable. Regarding the number of nodes characteristic, the hybrids (4 × 1), (4 × 2), (5 × 2), and (6 × 5) exhibited distinct and positive values for this trait. Additionally, it was noted that the hybrids (5 × 1), (4 × 2), (6 × 3), and (5 × 4) had positive and desirable values for the adjective number of florets, and the hybrids (2 × 1), (4 × 1), and (5 × 4) had favorable and desirable values for the contract ratio. (6 × 5) values favorable and appealing among this trait's hybrids. The pods weighed four by one, five by one, four by two, four by three, and five by three. Hybrids' favorable and desired values for this characteristic and the crucial outcome were for camels, the values are favorable and favorable (4 × 1 (6 × 1), (5 × 3), (6 × 3), and (6 × 5). About the grain quotient features, the hybrid was (5 × 1), (3 × 2), (4 × 2) and (5 × 2), (6 × 2), (5 × 3), (6 × 3), (6 × 4), and (6 × 5), but the camel (2 × 1), (4 × 1), (5 × 1), (5 × 3), (6 × 3), (5 × 4), and (6 × 5) had desired and positive values. (5 × 5) favorable and ideal values for the harvest guide's production and the weight of one hundred grains (g) Display the required and positive values for this characteristic in the hybrid (4 × 1), (5 × 2), (6 × 2), (4 × 3), (5 × 3), (6 × 4), and (6 × 5). Because the adjective displayed the number of flowering days for hybrids (1 × 3), (1 × 4), (1 × 6), (2 × 4), (3 × 6), and (4 × 6) good and desired values for the remaining hybrids, Table (6) also provided an estimate of the reverse effect of fifteen adjectives. On the other hand, the hybridization of the poisonous plant height characteristic was The following

values are positive and in the desired direction: (1 × 3), (1 × 4), (1 × 5), (1 × 6), (2 × 5), and (2 × 6), (3 × 5), (3 × 6), (4 × 5), and (5 × 6). The hybrids (1 × 3) and (1 × 4) as well as (1 × 6) and (3 × 6) had positive values in the desired direction, which described the total number of branches in the plant. The hybrids (1 × 4), (3 × 5), and (5 × 6) exhibited favorable and desired values for the number of pods on the main stem compared to the other hybrids. The pod's adjective length was hybrid. Between the hybrid values for any adjective, (1 × 3), (1 × 5), (1 × 6), and (2 × 6) (3 × 5) (4 × 5) are favorable and wanted. There were hybrids (1 × 3), (1 × 6), (2 × 6), (3 × 4), (3 × 5), and (4 × 5) seeds per pod, all of which had positive values and were moving in the right direction. The hybrid had the following node counts: 1 × 2, 1 × 4, 3 × 5, 3 × 6, and 4 × 6. The hybrids (1 × 6) and (2 × 4) had positive and desired values for this trait as well as the adjective number of flowers. Additionally, (2 × 6), (3 × 6), (4 × 5), and (5 × 6) were favorable and appealing. and the hybrids were (2 × 5), (3 × 4), and (3 × 5) values for the contract's adjective %. Positive and desirable values were found for this trait and the weight of the pods was for hybrids (1 × 4), (1 × 5), (3 × 5), and (3 × 6); for the vital product trait, the hybrids were (1 × 3 and (1 × 5), (1 × 6), (2 × 5), (3 × 5), (3 × 6), and (4 × 6). Additionally, the grain yield trait also had positive and desirable values. The intended and positive values were hybrid (1 × 3 and 1 × 4), (1 × 6), (3 × 5), (3 × 6), and (4 × 6). In contrast to the other hybrids. The hybrids (2 × 1), (1 × 5), (1 × 6), (2 × 5), (4 × 6, and (5 × 6) were favorable and desirable for the harvest guide's yield. As well as the adjective that weighs a hundred grains. For this adjective, camel (1 × 6) and camel (2 × 5) were favorable and preferred

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