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Studies on Transgressive Segregation for Pod Yield and Yield Attributes in F_2 Segregating Populations of four Groundnut Crosses

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ABSTRACT: The present study was carried out to recognize desirable transgressive segregants in four crosses *viz.*, Kadiri-6 × CS-19, Narayani × J-11, ICGV-07262 × TCGS-1862 and ICGV-07262 × TCGS-2149 of groundnut for days to 50% flowering, days to maturity, hundred pod weight, sound mature kernel %, shelling percentage, pod yield per plant and kernel yield per plant. Transgressive segregation was observed for all the characters in all the four crosses under study. The cross ICGV-07262 × TCGS-2149 registered highest number of transgressive segregants for pod yield per plant (107 plants), days to maturity (146 plants), hundred pod weight (103), shelling percentage (76 plants) and kernel yield per plant (101 plants). While the cross ICGV-07262 × TCGS-1862 recorded relatively more number of transgressive segregants for days to 50% flowering (97 plants) and harvest index (122 plants). This indicates that the parents possess divergent alleles governing respective traits from which all desirable alleles brought into a single genotype through meticulous selection. Further, evaluation of these segregants for different characters along with selection for yield to arrive at a desirable plant type through selection in later generations is more rewarding to isolate desirable high yielding pure lines.

Keywords: Groundnut, Transgressive segregants, pod yield and yield attributes.

INTRODUCTION

Groundnut is well known important oilseed crop in the world as well as in India because of its economic importance. The seed is comprised of 40-54 per cent oil, 25-28 per cent protein and 18 per cent of carbohydrates in addition to minerals and vitamins including vitamin E, niacin, phosphorus, falcin, calcium, riboflavin, magnesium, zinc, iron, thiamine, and potassium. Globally, it is cultivated in an area of 26.4 Mha with annual production of 37.1 Mt and productivity of 1405 kg ha^{-1}. In India, groundnut covers an area of 4.75 Mha with a production of 6.22 Mt and productivity of 1320 kg ha^{-1} (FAO, 2019-2020). In Andhra Pradesh, it is cultivated in an area of 6.61 lakh ha with a production of 8.50 lakh tonnes and productivity of 1285 kg ha^{-1}. (Directorate of Economics and Statistics, Govt. of A.P, India, 2019-2020).

The major growing states are Gujarath, Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Rajasthan and Maharashtra. These constitute around 80 per cent of total area and production. In Andhra Pradesh, Several factors like edaphic, climate, pests and diseases prevailing in the environment hinders yield. Hence, there is a need to focus on enhancement of yield through breeding followed by meticulous selection in advanced generations.

The primary aim of plant breeder is to generate a variety that will be superior to the existing one in terms of yield and this may be achieved by selecting the superior types from naturally existing variation or through hybridization followed by selection of best recombinants. Yield is complex trait governed by several genes and there are ample evidences to show that selection directly for yield in plants is not so easy. In formulating any crossing programme, genotype with high per se for yield is of prime requisite to obtain desirable segregants through selection in advanced generations. Production of transgressive segregants for yield and yield attributes plays a vital role in breeding programme and may be used as a positive tool in plant breeding.

The conventional idea of hybridization is to develop a new hybrid derivative for recombination of desirable characteristics already observed in their parents, perhaps a more appropriate approach is to consider the possibilities of using transgressive segregation.

Transgressive segregation refers to appearance of individuals, in the progeny from a hybrid, which exceed either of the two parents of the hybrid with respect to one or more characters (Shreya *et al.*, 2017). Although transgressive segregants includes lines which fall outside the range of performance of either parents, but only those being superior to better parents in desirable direction are of practical value. Such plants are produced by accumulation of favourable genes from both the parents as a consequence of segregation and recombination. Success in obtaining the desired transgressive segregants depends on obtaining genetic recombination between both linked and unliked alleles (Briggs and Allard, 1953). Keeping in view of the importance of transgressive segregants, the present investigation was carried in F_2 generation on inter varietal crosses of groundnut.

MATERIAL AND METHODS

The experiment was carried out during *rabi*- 2020 at the field unit of College Farm, S.V. Agricultural College located, Tirupati situated at an altitude of 182.9 m above mean sea level (MSL), 32.27°N latitude and 79.36°E longitude, geographically in southern agro climatic zone of Andhra Pradesh. The crop was grown by following all the agronomic practices as per the package of practices recommended by ANGRAU. The material for the present investigation comprised of F_2 of four crosses *viz*., Narayani × J-11, Kadiri-6 × CS-19, ICGV-07262 × TCGS-1862 and ICGV-07262 × TCGS-2149 along with their parents were grown in a Randomized Block Design replicated twice. Data on Days to 50% flowering, Days to maturity, Hundred pod weight, Sound Mature Kernel %, Shelling Percentage, Pod yield per plant and Kernel yield per plant was recorded from 180 F_2 plants from each cross and 40 plants from the parents, respectively.

RESULTS AND DISCUSSION

In the present study, transgressive segregants were identified that had values exceeding mean value of the higher parent or lagging behind the mean value of the lower parent. The number of such plants that fitted this definition were observed among F_2 plants of all the four crosses that surpassed the parental limits for Days to 50% flowering, Days to maturity, Hundred pod weight, Sound Mature Kernel %, Shelling Percentage, Pod yield per plant and Kernel yield per plant is presented in Table 1.

Table 1: Transgressive segregants for pod yield and yield attributes observed in F_2 generation of four crosses in groundnut.

Trait/Cross	F_2 mean	Max. value	Min. value	P_1	P_2	Number of transgressive segregants in F_2 generation (Population size = 180)	
						< lesser parent value	> Higher parent value
Days to 50% flowering							
KADIRI-6 × CS-19	30.92	34.00	28.00	30.83	29.78	9	129
NARAYANI × J-11	28.97	32.00	26.00	28.15	28.03	79	101
ICGV-07262 × TCGS-1862	31.58	35.00	29.00	31.95	31.22	97	82
ICGV-07262 × TCGS-2149	32.13	35.00	30.00	31.48	32.55	55	54
Days to maturity							
KADIRI-6 × CS-19	110.05	113.00	107.00	109.83	112.63	5	135
NARAYANI × J-11	110.04	120.00	94.00	96.08	115.13	15	38
ICGV-07262 × TCGS-1862	113.60	117.00	109.00	110.95	113.17	4	85
ICGV-07262 × TCGS-2149	109.77	118.00	105.00	112.40	111.13	146	16
Hundred pod weight							
KADIRI-6 × CS-19	148.42	446.81	39.41	144.00	150.83	94	72
NARAYANI × J-11	75.56	258.00	7.00	119.84	138.90	157	17
ICGV-07262 × TCGS-1862	122.60	581.40	14.93	155.66	161.54	144	32
ICGV-07262 × TCGS-2149	146.78	185.60	42.06	150.93	144.96	51	103
Sound Mature Kernel %							
KADIRI-6 × CS-19	86.47	97.16	75.30	86.34	85.77	82	85
NARAYANI × J-11	85.75	97.54	67.38	76.44	83.44	18	126
ICGV-07262 × TCGS-1862	87.16	99.13	59.01	86.09	86.75	55	116
ICGV-07262 × TCGS-2149	83.14	93.37	65.12	83.09	84.59	80	79
Shelling Percentage							
KADIRI-6 × CS-19	70.44	97.53	9.92	69.70	81.31	91	74
NARAYANI × J-11	67.47	99.09	26.80	70.64	56.62	38	67
ICGV-07262 × TCGS-1862	69.01	99.38	14.18	85.70	92.31	126	29
ICGV-07262 × TCGS-2149	68.82	99.19	13.60	76.95	84.92	90	76
Harvest Index %							
KADIRI-6 × CS-19	45.85	79.13	17.75	55.21	55.28	144	36
NARAYANI × J-11	53.13	88.24	24.15	49.90	49.42	74	106
ICGV-07262 × TCGS-1862	49.50	90.40	9.72	41.91	41.54	57	122
ICGV-07262 × TCGS-2149	51.55	84.67	16.84	50.71	53.43	95	73
Pod yield per plant							
KADIRI-6 × CS-19	13.84	24.50	4.10	16.58	15.02	53	105
NARAYANI × J-11	14.47	36.00	4.00	13.60	15.52	115	53
ICGV-07262 × TCGS-1862	14.90	40.20	1.90	12.60	13.00	80	97
ICGV-07262 × TCGS-2149	20.39	48.10	5.00	14.63	13.62	66	107
Kernel yield per plant							
KADIRI-6 × CS-19	9.91	22.50	1.20	11.13	11.83	104	68
NARAYANI × J-11	9.02	19.60	3.60	9.49	7.75	79	59
ICGV-07262 × TCGS-1862	9.07	25.80	1.10	10.51	11.97	137	35
ICGV-07262 × TCGS-2149	11.70	25.40	1.70	11.01	10.71	73	101

Transgressive segregants with lower values than the early parent are desirable for days to 50% flowering and days to maturity. The cross ICGV-07262 × TCGS-1862 (97 plants) registered the highest number of early flowering segregants followed by Narayani × J-11(79 plants), ICGV-07262 × TCGS-2149 (55 plants) and Kadiri-6 × CS-19 (9 plants) whereas the cross ICGV-07262 × TCGS-2149 (146 plants) recorded more number of early maturing segregants followed by Narayani × J-11(15 plants) and the crosses noticed lower number of transgressive segregants with 5 plants in Kadiri-6 × CS-19 and 4 plants in ICGV-07262 × TCGS-1862 respectively. The early flowering and maturing segregants can be utilized to develop varieties that rescues the crop from terminal drought stress.

The transgressive segregants with higher value of Hundred pod weight were more in F_2 generation of ICGV-07262 × TCGS-2149 (103 plants) followed by Kadiri-6 × CS-19 (72 plants), ICGV-07262 × TCGS-1862 (32 plants) and Narayani × J-11 (17 plants). Whereas, lower value of transgressive segregants for this trait were found more in the cross, Narayani × J-11 (157 plants) followed by 144 plants in ICGV-07262 × TCGS-1862, 94 plants in Kadiri-6 × CS-19 and 51 plants in ICGV-07262 × TCGS-2149.

The transgressive segregants with higher value of Sound Mature Kernel % were obtained more in F_2 generation of Narayani × J-11 (126 plants) followed by ICGV-07262 × TCGS-1862 (116 plants), Kadiri-6 × CS-19 (85 plants) and ICGV-07262 × TCGS-2149 (79 plants). While, lower value of Sound Mature Kernel % were high in Kadiri-6 × CS-19 (82 plants) followed by ICGV-07262 × TCGS-2149 (80 plants), ICGV-07262 × TCGS-1862 (55 plants) and Narayani × J-11 (18 plants).

The transgressive segregants with higher value of Shelling Percentage were observed high in F_2 generation of ICGV-07262 × TCGS-2149 (76 plants), Kadiri-6 × CS-19 (74 plants) followed by Narayani × J-11 (67 plants) and ICGV-07262 × TCGS-1862 (29 plants) and those with lower value of Shelling Percentage were recorded more in ICGV-07262 × TCGS-1862 (126 plants) followed by Kadiri-6 × CS-19 (91 plants), ICGV-07262 × TCGS-2149 (90 plants), while it was low in Narayani × J-11 (38 plants).

The transgressive segregants with higher value of pod yield per plant were recovered high in F_2 generation of ICGV-07262 × TCGS-2149 (107 plants) followed by Kadiri-6 × CS-19 (105 plants), ICGV-07262 × TCGS-1862 (97 plants) and Narayani × J-11 (53 plants) and those with lower value for this trait were observed more in case of Narayani × J-11 (115 plants), ICGV-07262 × TCGS-1862 (80 plants), ICGV-07262 × TCGS-2149 (66 plants) and Kadiri-6 × CS-19 (53 plants).

The transgressive segregants with higher value of kernel yield per plant were obtained high in F_2 generation of ICGV-07262 × TCGS-2149 (101 plants) followed by Kadiri-6 × CS-19 (68 plants), Narayani × J-11 (59 plants) and ICGV-07262 × TCGS-1862 (35 plants). Transgressive segregants with lower value of kernel yield per plant were recorded high in ICGV-07262 × TCGS-1862 (137 plants) followed by Kadiri-6 × CS-19 (104 plants), Narayani × J-11 (79 plants) and ICGV-07262 × TCGS-2149 (73 plants).

Similar results were reported by Jayalakshmi (2000) for majority of physiological and yield attributes, Monpara *et al.*, (2004) for pod yield per plant, Bagal (2016) for dry pod yield per plant and Shreya *et al.*, (2017), SCMR (SPAD Chlorophyll meter reading), SLA (specific leaf area), total biomass per plant, shoot weight per plant, root weight per plant, shelling out-run per plant, harvest index per plant, pod yield per plant and kernel yield per plant in groundnut and Manisha (2018); Sarode *et al*., (2020) for shelling percentage in groundnut.

CONCLUSION

As pod yield and other yield components showed transgressive segregation in all the four crosses it can be inferred that the parents possess divergent alleles for yield and its associated characters from which it could be inferred that there is a lot of scope to bring all desirable alleles into a single genotype through rigorous selection and evaluating the segregants to arrive at a desirable plant type through selection in later generations.

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