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Character Association Studies for Yield, Kernel Iron and Cinc Content in Groundnut (*Arachis hpogaea* L.)

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ABSTRACT

The field experiment was conducted at Dry land farm, Regional Agricultural Research Station (RARS), Tirupati during *rabi,* 2022-23 to study the correlation analysis for yield, kernel iron and zinc content in groundnut. Hundred groundnut genotypes along with four checks were considered for evaluating eleven traits which include kernel yield plant^{-1}, pod yield plant^{-1}, 100 pod weight, 100 kernel weight, kernel mass, shelling percentage, sound mature kernel percentage, kernel length, kernel breadth, iron and zinc content by selecting randomly five competitive plants in each genotype. Character association studies revealed that pod yield plant^{-1} showed positive and significant association with kernel yield plant^{-1} moreover, 100 pod weight, 100 kernel weight, kernel mass, shelling percent and kernel breadth showed significant and positive correlation with iron content. Shelling percent showed negative correlation with zinc content. Hence, these pod and kernel related traits can be directly used to improve the kernel iron content in groundnut.

Key words: *Checks, Character association, Groundnut and Yield*

Groundnut is popularly known as king of oilseeds. The cultivated peanut (*Arachis hypogaea* L.) is a self-pollinated crop with chromosomal number of 2n=4x=40. Groundnut is the second most important annual oilseed crop after soybean. Groundnut is also known as goober nut, monkey nut, manila nut, earth nut, poor man's cashew nut. Groundnut is both a cash crop and healthy food crop contributing to nutrition of farm families and households, and is also a source of nutritious fodder (haulms) for livestock. Groundnut kernels contain 47-53% oil and 25-36% protein (Prasad *et al.*, 2010) and also source of several vitamins, minerals, antioxidants, biologically active polyphenols, flavonoids and isoflavones (Janila *et al*., 2016).

Groundnut is popularly known as poor man's almonds for its high nutritional content with fat and protein making up 80% of seeds contents and is therefore a key contributor in the fight against malnutrition. Micronutrients represent the essential vitamins and minerals required for normal cellular and molecular functions (Jatav *et al.,* 2020). Iron and zinc are important micronutrients for human health (Upadhyaya *et al*., 2012). The localization studies, kernel tissues of ten divergent groundnut genotypes revealed that cotyledons contribute nearly 85-90% of iron and zinc than seed coat. In general, 100g of groundnut kernels can supplement 7% of human daily requirement of iron and zinc. Because of its gaining importance as food source across globe, identification of genotypes/donor sources and development of varieties with high kernel Fe and Zn content can alleviate malnutrition problems associated with Fe and Zn deficiency in developing countries like India. The breeders need to develop new varieties with preferred traits of farmers, industry and consumers and kernel features to ensure wider adoption and acceptance of new varieties and financial benefits to the farmers/ growers.

MATERIAL AND METHODS

Hundred genotypes along with four check varieties (Rohini, TPT 4, Kadiri 7 and Kadiri9) of groundnut that included released varieties from ANGRAU, different institutions and advanced breeding lines developed by RARS, Tirupati, ANGRAU; ICRISAT, Hyderabad and lines collected from AICRP on Groundnut, DGR (Directorate of

Groundnut Research) that possess diversity in kernel iron and zinc content were selected and sown during *rabi*, 2022-23 in an Augmented Design (RBD) in Regional Agricultural Research Station (RARS), Tirupati. Every genotype was sown in 2 rows of 3 m length with a spacing of 30 cm between rows and 10 cm between plants within the row. All necessary cultural operations along with proper plant protection measures were taken to control insect pests. Observations were recorded for hundred genotypes along with four checks separately on randomly chosen five competitive plants in each genotype for eleven characters *viz.,* kernel yield plant^{-1}, pod yield plant^{-1}, 100 pod weight, 100 kernel weight, kernel mass, shelling percentage, sound mature kernel percentage, kernel length, kernel breadth, iron and zinc content. Correlation coefficients were calculated.

RESULTS AND DISCUSSION

Pod yield plant^{-1} exhibited significant and positive correlation with kernel yield plant^{-1} (***0.95) and negative correlation (**-0.33) with shelling percent. Similarly, pod yield plant^{-1} was reported to have significant and positive correlation with kernel yield plant^{-1} (**0.675) in findings of Pachauri and Sikarwar (2023). Negative association of PYP with shelling percent indicated that, high pod yielding capacity of groundnut might lower the filling capacity of pod. Thus, enhancement of source capacity in high pod yielding varieties might increase the pod filling there by positiveness towards shelling percent. Similarly pod yield plant^{-1} showned negative and significant correlation with shelling per cent (-*0.207) in findings of Sadaiah (2015).

As expected, 100 pod weight revealed significant and positive correlation with 100 kernel weight (***0.65), kernel mass (***0.32), sound mature kernel (***0.51), kernel length (***0.54), kernel breadth (***0.54) and iron content (*0.23). 100 pod weight showed positive and significant correlation with shelling per cent (**0.938) in the studies of Sukrutha *et al*. (2022). Similar results of 100 pod weight that showed significant and positive association with 100 kernel weight (**0.769), shelling per cent (**0.913), sound mature kernel (**0.496) were reported by Pramanik *et al*. (2019).

100 kernel weight also had significant and positive correlation with kernel mass (***0.43), shelling per cent (***0.39), sound mature kernel (***0.44), kernel length (***0.35), kernel breadth (***0.53), iron (***0.32). Pramanik *et al*. (2019) reported significant and positive association of 100 kernel weight with sound mature kernel (**0.716) and shelling per cent (**0.953). Thakur *et al*. (2013) showed that hundred kernel weight had positive and significant correlation with kernel length (**0.420) and kernel width (**0.344). In contrary to current study, Upadhyaya *et al*. (2012) revealed a negative and significant association of 100 kernel weight with iron content in groundnut (*0.176).

Kernel yield plant^{-1} showed negative and significant correlation with shelling per cent (**-0.27). The studies of Divya sree (2022) revealed that kernel yield per plant has negative and significant effect on shelling percent.

Kernel mass exhibited positive and significant correlation with shelling per cent (***0.53), sound mature kernel (***0.37), kernel breadth (***0.32) and iron content (*0.19).

Shelling percent revealed positive and significant correlation with sound mature kernel (***0.38), kernel breadth (*0.19), iron content (*0.22), while zinc content (***-0.34) was significant and negatively correlated. Shelling percent was positively correlated with kernel breadth in the findings of Gangadhara and Gor (2022). In the reports of Upadhyaya *et al*. (2012) shelling percent was positive and significant with iron content (*0.415). The results obtained by Meta and Monpara (2010) for shelling percent had showed positive and significant correlation to sound mature kernel (**0.65).

Sound mature kernel was showed significant and positive correlation with kernel length (***0.37), kernel breadth (***0.47). Thakur *et al*. (2013) reported no correlation of sound mature kernel with kernel length (0.060) and kernel breadth (0.260).

Kernel length had significant and positive correlation with kernel breadth (***0.45). Prasanna kumari *et al*. (2020) revealed that kernel length was positively and significantly correlated with kernel breadth (0*.221) in rice. Donkor *et al*. (2022) also reported positive correlation of seed length to seed width (***0.458).

Kernel breadth recorded significant and positive correlation with iron content (*0.24). Sala and Geetha (2015) showed significant and positive correlation of kernel breadth with iron content (**0.531) in rice.

Iron content had no correlation with zinc content. Sukrutha *et al*. (2022) also reported similar results in groundnut. However, studies of Morgounov *et al*. (2007) in rice reported that iron was significant and positively correlated with zinc content (***0.79) Anuradha *et al*. (2017) also showed the positive and significant relationship of iron with zinc (**0.803) in rice.

Zinc was reported negatively significant with shelling percentage (***-0.34). However, Upadhyaya *et al*. (2012) showed no correlation of zinc content with shelling per cent (*0.161).

Thus, the genotypes that showed high 100 pod weight, 100 kernel weight, shelling percent, kernel mass, kernel breadth along with high iron content in the study can be selected for further use as either for direct release or to use as donors in kernel iron development breeding programmes in groundnut.

Table 1. Character association for yield attributing characters and micronutrient (iron, zinc) content and in groundnut

Character	PYP	100 PW	100 kW	KYP	KM	SP	SMK	KL	KB	Iron	Zinc
PYP	1	-0.041	-0.064	0.95***	-0.064	-0.33***	-0.079	-0.032	-0.046	0.096	0.051
100 PW		1	0.65***	0.022	0.32***	0.29**	0.51***	0.54***	0.54***	0.23*	0.025
100 kW			1	0.04	0.43***	0.39***	0.44***	0.35***	0.53***	0.32***	0.13
KYP				1	0.12	-0.27**	-0.01	-0.022	0.014	0.12	0.067
KM					1	0.53***	0.37***	-0.039	0.32***	0.19*	0.014
SP						1	0.38***	0.084	0.19*	0.22*	-0.34***
SMK							1	0.37***	0.47***	0.16	0.02
KL								1	0.45***	0.085	-0.051
KB									1	0.24*	-0.019
Iron										1	-0.091
Zinc											1

*****P = <0.001, **P = <0.01, *P = <0.05**

PYP- Pod Yield Plant^{-1} (g), 100 PW- Hundred pod weight (g), 100KW-Hundred kernel weight (g), KYP-Kernel Yield Plant^{-1} (g), KM-Kernel Mass (g), SP - Shelling Percent (%), SMK- Sound Mature Kernel (%) KL-Kernel Length (mm), KB-Kernel Breadth (mm), Iron (mg kg^{-1}), Zinc (mg kg^{-1})

Conclusion

To improve the pod yield plant^{-1} the traits such as kernel yield plant^{-1} can be taken as selection criteria which further helps in the development of high yielding genotypes in groundnut. Similarly, for enhancing the 100 kernel weight and 100 pod weight the traits kernel mass, shelling percent, sound mature kernel, kernel *length and kernel* breadth should be given due importance. 100 pod weight, 100 kernel weight, shelling percent, kernel mass, kernel breadth showed positive and significant association with kernel iron content. This indicates iron content in groundnut increases with increase in kernel mass, shelling percent and 100 pod and kernel weight.

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