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Correlation, regression and path coefficient analysis between morphological characteristics and grain yield of popcorn (*Zea mays everta*) under different levels of fertilizer and plant density

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Abstract
So as to examine correlation, regression and path coefficient analysis between between a morphological characteristics and grain yield of popcorn and to decide the best factors on its yield, an experiment was laid out at the Post Graduate Research Farm, College of Agriculture, Kolhapur during *Kharif* 2012. The investigation was directed as a factorial randomized complete block design with twelve treatments combinations comprising of three fertilizer levels *viz*., 75% RDF (90:45:30 Kg NPK ha^{-1}), 100% RDF (120:60:40 Kg NPK ha^{-1}) and 125% RDF (150:75:50 Kg NPK ha^{-1}) and four plant spacing levels viz., 60 x 15 cm^2, 60 x 20 cm^2, 75 x 15 cm^2 and 75 x 20 cm^2 and replicated thrice. *Grain yield was found to be significantly and positively correlated with* mean number of functional leaves $plant^{-1}$ *($r = 0.880^{**}$),* mean leaf area $plant^{-1}$ (dm^2) *($r = 0.965^{**}$),* mean dry matter accumulation $plant^{-1}$ (g) *($r = 0.913^{**}$). Similarly regression of grain yield on the* Mean plant height (cm) *($R^2 = 0.1135^{**}$),* Mean number of functional leaves $plant^{-1}$ *($R^2 = 0.7732^{**}$),* Mean leaf area $plant^{-1}$ (dm^2) *($R^2 = 0.9307^{**}$), LAI ($R^2 = 0.0633^{**}$),* Mean dry matter accumulation $plant^{-1}$ (g) *($R^2 = 0.8328^{**}$)showed a significant and positively associated between them.*

Keywords: Popcorn, plant densities and fertilizer levels.

Introduction
Maize is (*Zea mays L.*) one of the third most important cereals next to rice and wheat, in the world as well in India, contributing about 20% share of worlds total cereal production. It is one of the most versatile crops and can be grown in the diverse environmental conditions and has diversified uses in industries, human food and animal feed. It is a C_4 plant and efficient converter of nutrients resulting into high yield potential among all cereals.

The maize has tremendous potential in terms of feeds for dairy, poultry, piggery and agro-industries. The diversified uses of maize for starch industry, production of flour, corn oil, carbohydrates, glucose, maltose, ethanol, ayurvedic medicines, making soups, corn syrups, vegetable salads, It also provides good quality fodder for animals throughout the year and can be fed to animals at any stages of crop growth, as it does not contain HCN. Maize is classified in to different types on the character of the kernels (Kipps, 1959) [6], the various types of maize namely dent, flint, soft, waxy, sweet, pod, popcorn. Air-popped popcorn is very delicious and rich source of energy, nutritionally it is one of the best all-around snack food providing 78% carbohydrates, 15% dietary fiber and 12% protein with low in calories and fat free. The importance of popcorn as an article of commerce has developed since early 1980's. The popped maize is ready to eat products that could be used as snacks, breakfast cereals, and adjuncts in brewing. The demand for the popcorn products in the amusement parks, moving theatres, circus and exhibitions are increasing with the increasing urban population. There is an increasing tendency towards specialization in agriculture where commercial production would become more and more important. The productivity levels of popcorn is very low due to non – availability of appropriate agro-techniques and lack of awareness regarding their trade potential among the farmers. Development of good agronomic practices will lead to cultivation of popcorn in profitable way. Hence, the present investigation planned.

Material and Methods
A field experiment was conducted in during *kharif* season of 2012 at the Post Graduate Research Farm, College of Agriculture, Kolhapur, Maharashtra on medium black soil with pH 7.52, OC 0.43%, available N (174.64 kg ha^{-1}), available P_2O_5 (24.73 kg ha^{-1}) and available K_2O (240.69 kg ha^{-1}). The experiment was laid out in factorial randomized block design and the treatments were replicated thrice. There are 12 treatment combinations in the study and the

treatment consisted of three fertilizer levels viz., 75% RDF (90:45:30 Kg NPK ha^{-1}), 100% RDF (120:60:40 Kg NPK ha^{-1}) and 125% RDF (150:75:50 Kg NPK ha^{-1}) and four plant spacing levels viz., 60 x 15 cm^2, 60 x 20 cm^2, 75 x15 cm^2 and 75 x 20 cm^2. The certified seed of Amber popcorn (composite variety) was sown 28-6-2012 and harvested on 8-10-2012.

The Amber popcorn seeds were treated with Carbendazim (Bavistin) and Azotobacter @ 3 g kg^{-1} seed and 250 g for 10 kg seed, respectively. The ridges and furrows were opened at 60 and 75 cm spacings as per treatments. The seeds were dibbled at the rate of two seeds per hill on one side of ridge as per treatments i.e. 15 and 20 cm intra row spacings, where the fertilizer was applied. Thinning and gap filling was done at 10 DAS by keeping on seedling hill^{-1}. As per treatments, one third dose of nitrogenous fertilizer and full dose of phosphatic and potassic fertilizers were applied on one side of the ridge by leaving 1/3rd portion from bottom of furrow at sowing. The next one third dose of nitrogen fertilizer was applied in bands as top dressing one month after sowing and remaining one third dose of nitrogen fertilizer was applied at 45 days after sowing. The FYM @ 5 tone ha^{-1} was applied uniformly to all the plots after formation of ridges and furrows. The sources of nitrogen, phosphorus and potash were urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. The crop was maintained by adopting the recommended package of practices. The pre emergence application of herbicide, Atrazine @ 1 kg *a.i* ha^{-1} was undertaken next day after sowing, followed by one hand weeding at 30 DAS for weed control. Need based plant protection measures were taken up during crop growth period. The data on yield and quality parameters were recorded and analysed as per described by Panse and Sukhatme (1967) [9].

Results and Discussion

Correlations between Growth Parameters and Grain Yield

Correlation studies between growth parameters viz., Mean plant height (cm), Mean number of functional leaves plant^{-1}, Mean leaf area plant^{-1} (dm^2), LAI, Leaf area duration (75 DAS to Harvest), Mean dry matter accumulation plant^{-1} (g), Days to 50% tassel emergence, Days to 50% silk emergence and grain yield of popcorn were carried out and presented in Table 1.

The dependence of the grain yield was found to be significantly and positively correlated with mean number of functional leaves plant^{-1} (r = 0.880**), mean leaf area plant^{-1} (dm^2) (r = 0.965**), mean dry matter accumulation plant^{-1} (g) (r = 0.913**) observed in the present experiment (Table 1).

Regression between Growth Parameters and Yield

Regression equation obtained in the study revealed that, mean plant height (cm), mean number of functional leaves plant^{-1}, mean leaf area plant^{-1} (dm^2), LAI, Mean dry matter accumulation plant^{-1} (g), 11.35%, 77.32%, 93.07%, 6.22% and 83.28% of total variation in grain yield of rice (Figure 1.1 to 1.3)

Table 1: Correlation Studies in between popcorn grain yield versus growth of pooled means

	Variable 1	Variable 2	Variable 3	Variable 4	Variable 5	Variable 6	Variable 7	Variable 8	Variable 9
Mean plant height (cm)									
Mean number of functional leaves plant^{-1}	0.126^{NS}								
Mean leaf area plant^{-1} (dm^2)	0.301^{NS}	0.858**							
Leaf area index	0.912**	-0.021^{NS}	0.252^{NS}						
Leaf area duration (75 DAS to Harvest)	0.897**	-0.140^{NS}	0.108^{NS}	0.989**					
Mean dry matter accumulation plant^{-1} (g)	0.158^{NS}	0.920**	0.904**	0.015^{NS}	-0.116^{NS}				
Days to 50% tassel emergence	-0.195^{NS}	-0.856**	-0.903**	-0.187^{NS}	-0.061^{NS}	-0.844**			
Days to 50% silk emergence	0.013^{NS}	-0.897**	-0.809**	0.069^{NS}	0.192^{NS}	-0.867**	0.828**		
Grain yield (q ha^{-1})	0.337^{NS}	0.880**	0.965**	0.250^{NS}	0.114^{NS}	0.913**	-0.898**	-0.803**	

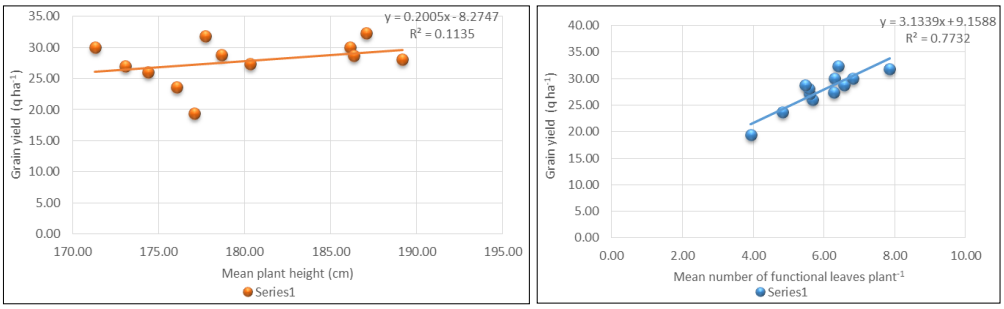

Fig 1.1: regression of grain yield of popcorn versus mean plant height (cm), mean number of functional leaves plant^{-1} of pooled means

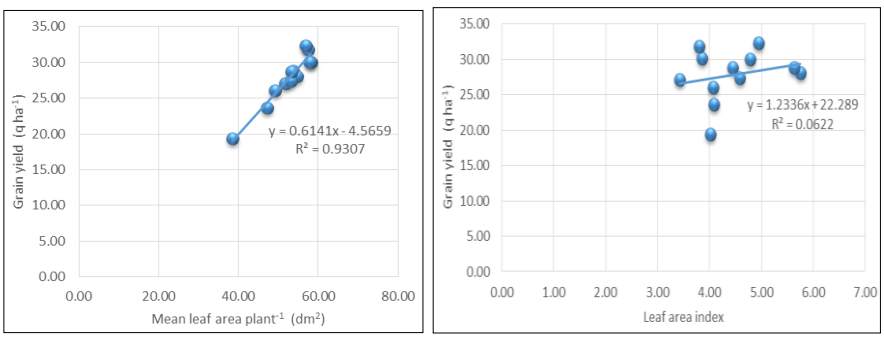

Fig 1.2: Regression of grain yield of popcorn versus mean leaf area plant^{-1} (dm^2), LAI of pooled means

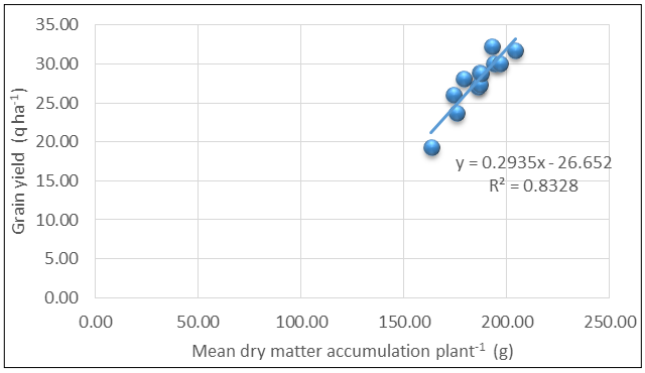

Fig 1.3: Regression of grain yield of popcorn versus mean dry matter accumulation plant^{-1} (g), of pooled means

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