Correlation studies in maize (*Zea mays* L.)

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Grain yield in maize is a complex character controlled by many factors. The knowledge of the degree of relationship between yield and yield component characters will aid the breeders to launch successful crop improvement programmes. Grain yield per plant had highest positive and significant genotypic correlation with cob weight, dry matter yield per plant, leaf breadth, harvest index, leaf area per plant, number of grains per row, stem girth, ear height, 100- grain weight, shelling percentage, plant height, cob length, leaf length, cob girth, number of rows per cob, number of leaves per plant. Days to 50 per cent tasseling and days to 50 per cent silking recorded significant and negative association with grain yield. Protein content and oil content showed positive and non-significant association with yield.

Maize (*Zea mays* L.) is the third important major cereal crop in the world after rice and wheat. Maize has several uses for human consumption, industrial purposes and animal feeds. Grain yield in maize is a complex character controlled by many factors. The correlation analysis is usually taken up to measure the relative magnitude of influence of each of this independent variable on a dependent variable like yield. Selection for desirable genotypes should be made based on grain yield and also other yield component characters which influence the yield. It has been generally accepted that correlation between different character pairs represents a co-ordination of physiological processes, which is often achieved through favourable gene linkages (Mather and Harrison, 1949). Knowledge of the strength and type of association is an important prerequisite for the formulation of breeding procedures (Breese and Haywards, 1972). The knowledge of the degree of relationship between yield and yield component characters will aid the breeders to launch successful crop improvement programmes. This review briefly deals about the association between grain yield and yield attributing traits.

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Correlation between yield and growth attributes:

Tyagi *et al*.(1988) and Basheeruddin *et al*. (1999) reported that number of leaves per plant was associated positively and significantly with grain yield per plant. Malhotra and Khehra (1986), Saha and Mukherjee (1993), Singh and Singh (1993) and Umakanth and Khan (2001) reported positive correlation of cob girth with grain yield per plant. Cob girth was positively and significantly correlated with all other traits except days to 50 per cent tasseling and days to 50 per cent silking.

Correlation between yield and yield attributes:

Dornescu (1973) reported that grain weight per ear was mainly dependent on ear weight. Probrecky (1976) concluded that yield depended primarily on the number of grains per plant, which in turn depended mainly on the number of grains in the row. Ear length had been a good indicator of this trait. 1000-grain weight and the number of rows in the ear were uncorrelated with grain yield. Utkhede and Shukla (1976) revealed highly significant positive genotypic and phenotypic correlation between yield and number of grain rows per ear, weight of ear, ear height and ear length. Ear height and dry ear weight contributed substantially to yield. Singh and Nigam (1977) found that grain yield was positively and significantly correlated with yield components. Zaika *et al*. (1978) reported fairly high correlation between mean ear weight and ear diameter and yield was closely correlated with mean ear weight.

Saha and Mukherjee (1985) observed that grain yield per plant was significantly correlated with ovules per ear, ovules per row, grains per ear, grains per row and 100-grain weight. Malhotra and Khehra (1986) concluded by studying 256 genotypes that grain yield was positively correlated with the yield components like ear length, ear circumference, number of rows per ear, 1000-grain weight, shelling percentage, days to silking, ear height and plant height. Singh *et al*. (1987) reported that 1000-grain weight and number of grains per ear were the most important components of yield, having the greatest and most direct effects. Yield was positively and significantly correlated with all other characters. Tyagi *et al*. (1988) in their study of correlation coefficients and path analysis have indicated that components effecting grain yield were ear weight,

ear length, plant height, kernels per row and 100-kernel weight in that order of importance. They revealed that the early maturing plants had relatively lower yield. Therefore, the breeder has to compromise between the yield and early maturity. Muthiah (1989) reported that cob weight was having the maximum correlation with grain yield. Mahajan *et al*. (1990) reported that kernel yield was positively correlated with ear length, number of kernels per row and plant height and they suggested that selection for these traits will be useful in selection and improvement in maize.

Paramathma *et al*. (1992) observed fodder yield was highly and positively correlated with plant height, stem girth, leaf breadth and leaf number. Rahman *et al*. (1995) reported that grain yield was significant and positively correlated with plant height, ear height, number of grains per ear and 1000-grain weight. Satyanarayana (1996) reported that grain yield was positively correlated with kernels per row, kernel rows per ear, ear length, ear girth and 100-grain weight. Kumar and Kumar (1997) noted that the values of genotypic correlation were slightly higher than the corresponding phenotypic values. Significant positive correlation was recorded for plant height, days to 50 per cent silking, ear length and ear weight with yield per plant. Jin and Wang (1997) recorded that 1000-kernel weight, rows per ear, ear diameter, kernels per row and kernel per cent had highest correlation with yield. Guirong *et al*. (1997) obtained direct correlation between yield and 1000-grain weight, rows per ear, ear diameter, kernels per row. Annapurna *et al*. (1998) showed that seed yield was positively and significantly correlated with plant height, ear height, number of seeds per row, number of seed rows per ear, number of seeds per ear and test weight.

Manivannan (1998) reported ear girth, kernel rows, 1000 seed weight, kernels per row and ear length had significant and positive correlation with seed yield. He further concluded that ear girth and kernel rows should be given more importance while formulating selection indices for yield improvement in maize. Khakim *et al*. (1998) reported that grain yield was positively correlated with plant and cob height, leaf area, ear number, ear length, row number, grain number per row, cob weight, 1000-grain weight, total protein yield and oil content. You *et al*. (1998) noted that the number of kernel rows per ear was positively correlated with number of kernels per row. Gautham *et al*. (1999 a) showed that grain yield was positively correlated with ear length, ear girth, grain rows, 1000-grain weight, plant height and ear height. Gautham *et al*. (1999 b) suggested that maximum correlation of grain yield was obtained with number of kernels per row followed by leaf area, plant height, tassel length and cob length. Mani *et al*. (1999) observed that grain yield per plant had highly significant and positive correlation with ear weight, ear height and 100-grain weight, where the highest significance was with ear weight per plant. Firoza Khatum *et al*. (1999) reported that grain yield per plant was positively and significantly correlated with 1000 grain weight, number of kernels per ear, ear girth and ear insertion height.

Rather *et al*. (1999) observed that days to 50 per cent silking were positively correlated with ear height and grain yield. Netaji *et al*. (2000) noted that the grain yield per plot was significantly and positively correlated with 50 per cent tasseling, silking and dry husk. Umakanth *et al*. (2000) observed that grain yield was positively correlated with plant height, 1000-grain weight and kernels per ear. But days to 50 per cent silking had negatively correlated with yield. Vaczi *et al*. (2000) noticed that grain yield was significant and positively correlated to ear weight, ear circumference, ear diameter, kernel weight, number of kernels per row.

Nigussie and Zelleke (2001) reported that the positive correlation was found for grain weight and prolificacy and negative correlation found in days to tasseling and prolificacy. Pradeep Kumar and Satyanarayana (2001) concluded that grain yield was positively associated with plant height, ear height, ear girth, number of seed rows per ear and test weight. Umakanth and Khan (2001) observed that grain yield per plot showed significant and positive correlation with ear girth, ear length, plant height and 100-seed weight. Kayalvizhi (2002) noticed that grain yield had significant and positive correlation with grains per row, plant height, ear diameter, days to 50 per cent silking, tasseling, ear height, ear length and 100-grain weight. According to Kabdal *et al*. (2003) the grain yield is significantly and positively correlated with plant height, ear height and ear length. Sriani Sujiprishati *et al*. (2003) observed that grain yield of the hybrids was most highly correlated with grain weight and grain weight per ear. Flowering and maturity characters were negatively correlated with 100-grain weight, and grain yield. Betrain *et al*. (2003) found that the grain yield for hybrids was positively correlated with mid parent heterosis and high parent heterosis.

Correlation between yield and quality attributes:

Maize oil is a rich source of nutritive oil with least detrimental effect on human health. The energy value of corn oil is approximately 2.25 times that of starch. It appears that the oil content of the corn grain may be increased as much as three per cent without loss in yield. Protein content and oil content was positively and non-significantly correlated with yield. Krishnaveni (1983)

observed that protein content ranged from seven to 12 per cent and the protein values exhibited a highly significant negative correlation with r-value 0.639. Tomov and Ivanov (1988) showed that correlation coefficient between grain yield and protein content was low in hybrids. Lico (1989) indicated that by crossing the lines containing 11 per cent protein with testers containing nine per cent protein resulted in high yielding hybrids with 1-1.5% more protein. Dwivedi and Godawat (1994) found positive and significant correlation of protein content and oil content with grain yield. Protein content was positively and significantly correlated with number of leaves per plant, leaf breadth, leaf area per plant, cob girth and number of grains per row. Oil content was positively and significantly correlated with days to 50 per cent tasseling, leaf breadth, leaf area per plant, cob length and cob girth. Tomov and Min (1995) observed that as grain yield increased, crude protein content decreased with greater maturity. Sivakumar (1996) studied that the oil was significantly and positively correlated with protein. Protein was significantly and negatively correlated with plant height, grain yield per plot, number of rows per ear, 100-seed weight, ear girth and ear height. Basheeruddin *et al*. (1999) concluded highly significant and positive influence of plant height, number of leaves, leaf area, crude protein content, stem girth and ear height on yield in a correlation coefficient study with 80 F_1 progenies and 12 parents. Cao Yong Guo *et al*. (1999) concluded that oil content also increased seed protein and lysine content significantly but reduced yield, 100-grain weight, ear weight, grain weight per ear, plant height and ear diameter. Kumar and Kumar (2000) reported positive and significant correlation of oil content with grain yield per plant. The oil content is positively correlated with lateness and negatively correlated with number of seed rows per ear, number of seeds per ear and 100-seed weight. Crude protein was negatively correlated with total starch. Okoruwa (1999) reported significant differences among cultivars for 1000-kernel weight and chemical properties *viz.*, starch, protein, fat and total sugars. Paztor *et al*. (1998) observed that an increase in 1000 kernel weight was accompanied by a rise in the starch and protein content.

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