



## Growth and yield performance of three maize (*Zea mays* L.) cultivars sown in pure and blend forms

Shamshad Hussain Shah, M. Farrukh Saleem, Shahid Ibni Zamir and Tanveer Hussain

Department of Agronomy, University of Agriculture, Faisalabad, Pakistan.

e-mail: pk\_hussain@yahoo.com; Farrukh\_Sair@med.unc.edu; hussains20@yahoo.com

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### Abstract

Present investigations were conducted to examine growth and yield performance of maize cultivars (Agaiti-85, Golden and Akbar) sown in pure and blend forms. The crop was sown on a sandy clay loam soil. The experiment was laid out in a randomized complete block design with three replications and the net plot size was 3m x 5m. Nitrogen and phosphorus were added at 175 kg and 120 kg ha<sup>-1</sup>, respectively. The results showed that silking was significantly delayed when cv. Akbar was sown alone or in blend form. Leaf area recorded per plant of cv. Akbar was significantly higher than others. Plant height, however, was significantly lower in all the varieties when sown alone as compared to that sown in combination. The yield and yield contributing parameters of the crop namely, number of cobs plant<sup>-1</sup> (1.2), number of grains cob<sup>-1</sup> (493.3), grain rows cob<sup>-1</sup> (15.2) and 1000-grain weight (223.4 g), were the highest in treatment where Golden and Akbar were grown in blended form (1/2 + 1/2). Similarly highest grain yield (4.0 t ha<sup>-1</sup>) and stalk yield (11.5 t ha<sup>-1</sup>) were also obtained from the blend sowing of both the varieties.

**Key words:** Maize cultivars, nitrogen, phosphorus, pure and blend sowing.

### Introduction

Many factors are responsible for low yield of maize in Pakistan. Out of which the most important one is the poor soil fertility owing to low organic matter content of the soil which is less than 1%<sup>1</sup>. Contributors to yield advantages which are obtained by mixing of two or more crops include; better use of growth resources<sup>2</sup>, better control of weeds, pest and diseases<sup>1</sup>, maintenance of soil fertility<sup>4</sup> and efficient use of nutrients<sup>5</sup>. Blending of two or more varieties of the same crop may also increase the fertility of soil due to their different rooting patterns (shallow rooted, deep rooted and medium spreading type roots) and thus stabilize or increase the yield as compared to components grown in pure stand<sup>5</sup>. It was reported by Shahzad et al<sup>6</sup> that in wheat, blend yielded higher than pure stand, while<sup>7</sup> concluded that blend decreased severity of diseases and resulting increase in grain yield ranged between 0.5-6.8% in barley crop. With this in view, the present study was conducted to investigate growth and yield performance of three maize cultivars sown in pure as well as in blend forms under the agro-ecological conditions of Faisalabad.

### Materials and Methods

Investigations to study growth and yield performance of three maize cultivars sown in pure and blend forms were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad during the year 2000. The crop was sown on a sandy clay loam soil. The experiment was laid out in a randomized complete block design (RCBD) with three replications and the net plot size was 3 m x 5 m. The experiment comprised of six treatments i.e. three cultivars, Agaiti-85, Golden and Akbar each sown in pure stand; Agaiti-85 and Golden, Golden and Akbar and Agaiti-85 and Akbar each sown in blend (1/2 + 1/2). Maize cultivars were sown on August 18, 2000. Seeds were sown in lines (75 cm apart) on a well prepared seedbed using single row hand drill and the seed rate used was 30

kg ha<sup>-1</sup>. The whole phosphorus and 1/3rd nitrogen were side dressed as a basal dose with the help of a single row hand drill about 5 cm deep into the soil and about 10 cm away from plant rows. Remaining nitrogen was applied in two doses i.e. 1/3rd with second irrigation and 1/3rd at initiation of tasseling. The crop was harvested on Nov. 13, 2000. All other agronomic practices were kept normal for all treatments. Standard procedures were followed to record data on different growth and yield parameters of the crop. Data collected were analyzed statistically according to Fisher's Analysis of Variance Technique and least significant difference (LSD) test at 5% probability was applied to test the significance of treatments' means<sup>8</sup>.

### Results and Discussion

Data on growth and yield parameters of the crop as affected by different treatments are given in Table 1 which clearly show that none of the treatments had a significant effect on this parameter. The germination count ranged from 31.3 to 33.5. This may be due to the seeds sown on a well prepared seedbed providing favourable conditions for uniform seed germination. These results are in agreement with that of Laing et al<sup>9</sup>. Differences in the number of days taken to tasseling in different treatments were not significant. Maximum number of days (45.6) were recorded in T<sub>5</sub> where Golden and Akbar were sown after blending i.e. 1/2 + 1/2. Similar findings were reported by Toor<sup>10</sup>. Days taken to silking were significantly affected by different treatments and maximum number of days for silking (49.6) was recorded in T<sub>5</sub> where Golden and Akbar were sown in a blend but it was not statistically different from either T<sub>6</sub> or T<sub>3</sub> which on an average took 47.6 days for silking. Non-significant differences were found among T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>6</sub> but they took significantly more days than that of T<sub>1</sub>. Minimum number of days to silking (41.6) were recorded in T<sub>1</sub> but it was on par with T<sub>2</sub> and T<sub>4</sub>. These results show that the treatments where tasseling was delayed showed delayed silking. Days taken to maturity were

**Table 1.** Growth parameters of three maize cultivars sown in pure and blend forms.

Treatments	Germination count (m <sup>-2</sup> )	Days to tasseling	Days to silking	Days to maturity	Total leaf area plant <sup>-1</sup> (cm <sup>2</sup> )	Plant height (cm)
T <sub>1</sub> = Agaiti 85	32.8	39.0	41.6c*	84.0	3695.0f	179.3b
T <sub>2</sub> = Golden	32.1	42.6	45.0bc	92.3	4096.2e	186.1b
T <sub>3</sub> = Akbar	33.4	43.3	48.6ab	91.0	5022.8d	186.4b
T <sub>4</sub> = Agaiti 85 + Golden (½ + ½)	31.3	41.0	45.0bc	89.6	5173.8c	212.4a
T <sub>5</sub> = Golden + Akbar (½ + ½)	33.0	45.6	49.6a	89.6	5608.8a	206.0a
T <sub>6</sub> = Agaiti 85 + Akbar (½ + ½)	33.5	43.0	46.6ab	91.0	5317.4b	205.2a
Standard error	1.11	1.46	1.45	1.66	21.68	4.49

\*Any two means not sharing a letter in common differ significantly from each other at 5% probability level.

**Table 2.** Yield and yield components of three maize cultivars sown in pure and blend forms.

Treatments	Number of cobs plant <sup>-1</sup>	Grain rows cob <sup>-1</sup>	Number of grains cob <sup>-1</sup>	1000-grain weight (g)	Grain yield (t ha <sup>-1</sup> )
T <sub>1</sub> = Agaiti 85	0.9c*	14.3c	439.5d	196.6d	2.9e
T <sub>2</sub> = Golden	1.0bc	14.2c	453.2c	204.9c	3.0d
T <sub>3</sub> = Akbar	1.0bc	14.4bc	463.8b	198.5d	3.1d
T <sub>4</sub> = Agaiti 85 + Golden (½ + ½)	1.1ab	14.7abc	463.9b	209.4b	3.3b
T <sub>5</sub> = Golden + Akbar (½ + ½)	1.2a	15.2a	493.3a	223.4a	4.0a
T <sub>6</sub> = Agaiti 85 + Akbar (½ + ½)	1.1a	15.2ab	468.1b	211.2b	3.2c
Standard error	0.041	0.24	3.01	1.21	0.026

\*Any two means not sharing a letter in common differ significantly from each other at 5% probability level.

**Table 3.** Meteorological data recorded during the crop growth period.

Month Average	R.H. (%)	Total rainfall (mm)	Average Max. Temp. (°C)	Average Min. Temp. (°C)
August	74.0	100.0	37.9	27.7
September	75.4	19.7	35.2	25.3
October	70.2	4.0	34.0	20.1
November	77.4	0.0	29.4	11.6

Source: Deptt. Agro-Meteorology, U.A., Faisalabad.

at par in all the treatments and ranged from 84.00-92.33. Non-significant differences may be due to the fact that all varieties were sown and blended at the same time and that favourable environments prevailing at maturity of the crop (see Meteorological data in (Table 3). These findings are in conformity with those of Toor<sup>10</sup>, Alvi<sup>11</sup> and Shahzad et al.<sup>6</sup>. Data on total leaf area plant<sup>-1</sup> reveal that treatments differed significantly from one another. The plants of Golden and Akbar in blended form (1/2 + 1/2) produced the maximum leaf area i.e. 5608.8 cm<sup>2</sup> and it was followed by T<sub>6</sub> (5317.8 cm<sup>2</sup>). The total leaf area was the lowest (3695.0 cm<sup>2</sup>) in T<sub>1</sub>, where Agaiti 85 was sown alone. The total leaf area per plant was significantly greater when maize varieties were sown after blending than that when sown individually. Similar findings were reported by Kawano et al.<sup>12</sup> who studied intergenotypic competition among 25 cultivars of rice and got a larger leaf area in mixed population as compared to pure population. Pure and blend forms of maize differed significantly from one another with respect to plant height which was maximum (212.4 cm) in T<sub>4</sub> where Golden and Agaiti 85 were sown blended but it was at par with either T<sub>5</sub> or T<sub>6</sub>. Non-significant differences were found among treatments T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> where each variety was sown as sole crop and they significantly produced shorter plants than that sown them in blend form. The results are in conformity with the findings of Hoekstra et al.<sup>13</sup> who reported that plant height taken at maturity of maize was

significantly higher in blended treatments than that when planted alone. A perusal of data on yield and yield components of maize shows that the number of cobs formed plant<sup>-1</sup> in each treatment differed significantly (Table 2). Maximum number of cobs plant<sup>-1</sup> (1.2) was found in T<sub>5</sub> where Golden and Akbar were sown in blended form but it did not differ significantly from T<sub>4</sub> and T<sub>6</sub> which were at par with each other and produced 1.1 cobs plant<sup>-1</sup>. Minimum number of cobs plant<sup>-1</sup> (0.9) were recorded in T<sub>1</sub> wherein Agaiti 85 was sown alone. Non-significant differences were found among T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub> where the three maize varieties were grown alone. These results are in agreement with the findings of Khalifa and Qualset<sup>14</sup>. Grain rows cob<sup>-1</sup> were also significantly affected by various treatments. These were significantly higher (15.2) in T<sub>5</sub> than that produced in either T<sub>1</sub> or T<sub>2</sub> or T<sub>3</sub> or T<sub>4</sub> which were at par with one another and on an average produced 14.4 grain rows cob<sup>-1</sup>. The differences in nutrient uptake from different depths of soil due to possible variation in root lengths in blend treatment might have caused to produce healthier plants resulting in increased number of grain rows cob<sup>-1</sup>. These results are in agreement with that reported by Chang<sup>15</sup>. As regards the number of grains cob<sup>-1</sup>, maximum number (493.3) was produced in T<sub>5</sub> where Golden and Akbar were blended. It was followed by T<sub>6</sub>, T<sub>4</sub> and T<sub>3</sub> which produced 468.1, 463.9 and 463.8 grains, respectively and these treatments in turn were at par with one another. The number of

grains cob<sup>-1</sup> were lowest (439.5) in T<sub>1</sub>. This is due to the fact that increase in rows cob<sup>-1</sup> in blended treatments over sole cropping increased the number of grains cob<sup>-1</sup>. Similar results were obtained by Chang<sup>15</sup>. Weight per 1000-grains in T<sub>5</sub> was the highest (223.4 g) of all the treatments. It was followed by T<sub>4</sub> and T<sub>6</sub> which did not differ significantly from each other producing heavier grain than that produced in T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Khan<sup>16</sup> and Prasad and Sharma<sup>17</sup> also reported that blending of different cultivars increased the 1000-grain weight over that of the varieties sown separately as sole crop. A scrutiny of grain yield recorded in t ha<sup>-1</sup> shows that maximum grain yield (4.0 t ha<sup>-1</sup>) was obtained in T<sub>5</sub> where the crop was sown in a blend form (Golden + Akbar). This was followed by T<sub>4</sub> which yielded 3.3 t ha<sup>-1</sup> of grains and it significantly out-yielded rest of the treatments. The minimum grain yield was obtained in T<sub>1</sub> (2.9 t ha<sup>-1</sup>) where Agaiti 85 was sown as a sole crop. Increase in grain yield in T<sub>5</sub> is attributed to increase in grain rows cob<sup>-1</sup>, number of grains cob<sup>-1</sup> and 1000-grain weight. Brim and Schutz<sup>18</sup> suggested that genotypic behaviour in a competitive situation was a reliable criterion for predicting superior varietal blends. They further concluded that mixture of four soybean lines produced more grain and stalk yield than in pure stand and were more efficient in mixture than pure stand. The results lead to the conclusion that the varieties generally performed better in their growth and yield aspects when sown in blended form as compared to their sowing individually at one time.

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