Effect of Hybrid on Starch, Protein and Yields of Maize Grain

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Abstract: This study was conducted to determine, the effect of hybrid on the starch, protein content of maize grain and relationship among starch, protein content and some yield parameters of maize grain. Hybrid had a significant ($p<0.001$) effect on the starch and crude protein content of maize grain whereas, hybrid had no significant ($p>0.05$) effect on the grain yield, starch yield and crude protein yield of maize. The starch content of maize grain ranged from 69.29-73.71%. Heroic and Progen 1550 had a significantly ($p<0.001$) higher starch content than those obtained for Pioner 35Y65. The crude protein contents of hybrids ranged from 8.91-11.65% whereas in the current study hybrid had no significant ($p>0.05$) effect on the grain yield, starch yield and protein yield of maize. The grain yield ranged from 9561.6-11554.3 kg ha^{-1}. The starch yield ranged from 6626.2-8425.2 kg ha^{-1}. Crude protein yield ranged from 1065.9-1249.0 kg ha^{-1}. There is a significant ($p<0.001$) correlation among starch, protein and yield parameters. The crude protein content decreased with increasing starch content and grain yield.

Key words: Maize grain, hybrid, starch, crude protein, dry matter yield, starch yield, protein yield

INTRODUCTION

Maize plant is grown in most parts of world for grain and silage production to meet the energy requirement of livestocks. The introduction of new corn hybrids has resulted in feed raw materials with a range of nutritional characteristics. It is well know that hybrid selection is a very important decision taken every year in practical farm condition. There is limited information about the chemical composition and grain yield of different maize hybrids. The chemical composition and grain yields were affected by growing site, N fertilization, harvesting maturity, plant density etc. (Maier *et al.*, 1997; Thomison *et al.*, 2004; Zeidan *et al.*, 2006; Harrelson *et al.*, 2008; Raymond *et al.*, 2009).

The aim of this experiment was to determine, the effect of hybrid on the chemical composition and relationship among chemical composition and yield parameters of different maize hybrids.

MATERIALS AND METHODS

Corn grain: A conventional five maize hybrids (P 35Y65, Luce, Heroic, Progen and BC566) were shown in triplicate plots in June 2008 with N (250 kg ha^{-1}) fertilization as a second crop. The maize hybrids were harvested in November 2008 when the grain is matured.

Chemical analysis: Dry matter content was determined by drying the samples at 105°C overnight and the ash by igniting the samples in a muffle furnace at 525°C for 8 h. Nitrogen (N) content was measured by the Kjeldahl method. The CP was calculated as N ×6.25. Starch content of maize grain was determined by Ewers polarimetric method.

$$\text{Starch yield (kg ha}^{-1}) = \text{Grain yield (kg ha}^{-1}) \times \text{Starch content of maize grain (\%)}$$

$$\text{Protein yield (kg ha}^{-1}) = \text{Grain yield (kg ha}^{-1}) \times \text{Protein content of maize grain (\%)}$$

Statistical analysis: One-way Analysis of Variance (ANOVA) was carried out to compare the starch, protein contents and yield parameters of maize grain using General Linear Model (GLM) of Statistica for windows (Stastica, 1993).

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Significance between individual means was identified using the Turkey's multiple range test. Mean differences were considered significant at p<0.05. Standard errors of means were calculated from the residual mean square in the analysis of variance.

As a complement of ANOVA procedure, a simple correlation analysis used to establish the relationship between chemical composition and yield parameters of maize.

RESULTS AND DISCUSSION

The effect of hybrids on the chemical composition of maize grain is given in Table 1. The hybrid had a significant effect on the chemical composition of maize grain. The starch content of maize grain ranged from 69.29-73.71%. Heroic and Progen 1550 had a significantly higher starch content than those obtained for Pioner 35Y65. This result is in agreement with findings of Maier *et al.* (1997) and Harreelson *et al.* (2008). As can be shown in Table 1, starch is the largest single components in maize grain and the primary energy source.

The crude protein contents of hybrids ranged from 8.91-11.65%. Hybrid BC566 had a significantly higher CP content than those obtained for Pioner 35Y65, Luce, Heroic and Progen 1550. This result is agreement with findings of Maier *et al.* (1997) and Harrelson *et al.* (2008).

The effect of hybrids on the grain, starch and protein yields of maize grain is given in Table 2. As can be shown in Table 2 hybrid had no significant effect on the grain, starch and protein yields of maize grain. The grain yield ranged from 9561.6-11554.3 kg ha^{-1}. This result is consistent with findings of Raymond *et al.* (2009), who found that the grain yield for maize ranged from 7001-16134 kg ha^{-1}. Raymond *et al.* (2009) shown that the plant density and maturity had a significant effect on the grain yield.

The starch yield ranged from 6626.2-8425.2 kg ha^{-1}. Crude protein yield ranged from 1065.9-1249.0 kg ha^{-1}.

Correlation coefficients (r) of the relationship between composition and grain, crude protein and starch yields is shown in Table 3.

There is a significant relationship among chemical composition and yield parameters.

As can be shown in Table 3, there is significant (p<0.001) negative relationship between starch content and crude protein. The crude protein content decreased with increasing starch content of maize grain. This result

Table 1: Effect of hybrid on the chemical composition of maize grain

Parameters	Constituents (%)		
	Dry matter	Starch	Protein
Pioner 35Y65	90.340	69.390[b]	10.810[b]
Luce	90.290	71.500[ab]	10.370[c]
Heroic	90.890	73.710[a]	8.910[e]
Progen 1550	90.190	73.170[a]	9.370[d]
BC566	91.250	69.290[b]	11.650[a]
SEM	0.295	0.653	0.098
Sig.	NS	***	***

Table 2: Effect of hybrid on the grain, protein and starch yield of maize grain

Parameters	Yields		
	Grain	Starch	Protein
Pioner 35Y65	11554.3	7470.7	1249.0
Luce	10513.0	7516.8	1090.2
Heroic	11398.6	8401.9	1016.7
Progen 1550	11376.3	8425.2	1065.9
BC566	9561.6	6626.2	1113.9
SEM	1171.4	788.0	118.8
Sig.	NS	NS	NS

[a-c]: Column means with common superscripts do not differ (p>0.05), SEM: Standard Error Mean, Sig.: Significance level, NS: Non-Significant

Table 3: Correlation coefficients (r) of the relationship between composition and grain, crude protein and starch yields

Parameters	Starch	Crude protein	Grain yield	Starch yield
Crude protein	-0.916***			
Grain yield	0.486[NS]	-0.710**		
Starch yield	0.308[NS]	-0.338[NS]	0.399[NS]	
CP yield	-0.788***	0.635*	0.087[NS]	-0.085[NS]

CP: Crude Protein (%), NS: Non-Significant at p>0.05; ***p<0.001, **p<0.01, *p<0.05

is in agreement with findings of Harrelson *et al.* (2008), who found a significant negative relationship (r = -0.41) between starch content and crude protein yield.

CONCLUSION

The hybrid had a significant effect on the starch and protein content of maize grain. There is inverse relationship between starch and protein. There is also, inverse relationship protein and grain yield. Therefore, hybrid selection should be done with care for specific end-uses and these inverse relationships should be taken into consideration.

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