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QUALITY PARAMETERS OF MAIZE AS INFLUENCED BY APPLICATION OF FERTILIZERS AND MANURES

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ABSTRACT

An investigation to study the biochemical changes in maize under continuous application of fertilizers and manures was undertaken with ten treatments at Tamil Nadu Agricultural University, Coimbatore. The NPK + FYM treatment resulted in producing maize grain of better quality. The non-addition of any fertilizer, elimination of S and K significantly reduced the grain quality. No appreciable variation could be observed with different levels of NPK in the quality constituents such as starches, protein, carbohydrates, sugars and phenols.

KEY WORDS : NPK + FYM, Starch, Protein, Carbohydrates, Sugars, Phenols

Recently, the grain quality assumes significance from productivity considerations. The grain quality is an integrated effect of the nutritional, physiological and biochemical factors (Srivastava and Mehrotra, 1991). As a general rule, the amount of starch/protein/carbohydrates/ sugars accumulating in the grain is a genetic parameter. Little information is available regarding the biochemical changes in maize due to fertilization. Hence, important quality constituents of maize grain as influenced by long term application of fertilizers and manures were investigated in this study.

MATERIALS AND METHODS

The study pertains to the All India Co-ordinated Project sponsored by the ICAR on Long Term Fertilizer Experiments (LTFE) which is in progress since 1972 in Tamil Nadu Agricultural University, Coimbatore. The area under investigation is medium black soil of clay loam texture. The experiment was laid out in randomised block design comprising ten treatments replicated four times. The treatments are: (1) 50% NPK, (2) 100% NPK, (3) 150% NPK, (4) 100% NPK + Hand weeding, (5) 100% NPK + $ZnSo_4$ (25 kg/ha), (6) 100% NP, (7) 100% N, (8) 100% NPK + FYM (10 t/ha), (9) 100% NPK (S free) and (10) Control. The recommended doses of N, P_2O_5 and K_2O to maize grown during 1994 as 55th crop in the sequence were 135, 67.5 and 35 kg/ha. Maize grain samples were collected from each of the treatments and analysed for quality parameters. Total sugars, carbohydrates and starch were determined as per Hodge and Hofreiter (1962). Reducing sugars were determined by Nelson- Somogyi's method (Nelson, 1944). Phenols (Malick and Singh 1980), total N content (Humphries, 1956) were estimated and N content was multiplied with the factor 6.25 to arrive the crude protein.

RESULTS AND DISCUSSION

Sugars

The FYM treatment resulted high content of reducing sugars (1.08%) in the grains (Table 1) which might increase sweetness and enhance palatability. Increased rates of NPK promoted the per cent of reducing sugars (0.65 to 0.92) which in turn reflect the better quality, while the unmanured treatment recorded lower values of reducing sugars and higher amount of non-reducing sugars which resulted in low quality. This fact is in confirmity with the findings of Pal *et al* (1983).

Crude protein

The crude protein varied marginally from 10.22 to 12.19 per cent, implying the influence of treatment differences on this quality parameters. The absence of either FYM or inorganic fertilizer is found to be reflected in lowered protein value of the maize grain (Reddy *et al.*, 1990) and the continuous organic farming is of considerable value in increasing the protein (Addy *et al.*, 1987). These could be attributed to the poor nutrition with concomittant effects on physiological/bio chemical relations in the absence of organics and upgraded fertility environment with extended benefit of more

Table 1. Influence of treatment on biochemical constituents of maize

Treatment	Reducing sugars (%)	Total sugars (%)	Crude protein (%)	Starch (%)	Total carbohydrates (%)	Phenols (%)
50% NPK	0.66	1.21	10.33	56.50	61.00	0.13
100% NPK	0.73	1.23	11.25	54.50	58.50	0.14
150% NPK	0.85	1.27	11.71	52.00	57.00	0.15
100% NPK + Hand weeding	0.92	1.18	11.35	55.40	60.50	0.14
100% NPK + $ZnSO_4$ (25 kg/ha)	0.79	1.22	11.25	56.40	61.00	0.12
100% NP	0.87	1.16	11.63	52.75	57.50	0.10
100% N alone	0.87	1.22	11.94	54.93	59.00	0.12
100% NPK + FYM (10 t/ha)	1.08	1.31	12.19	60.20	65.00	0.18
100% NPK (S free)	0.70	1.29	10.94	54.00	59.50	0.15
Control	0.65	1.13	10.22	51.00	56.00	0.07
CD (5%)	0.06	0.09	0.98	3.63	4.20	0.02

congenial biochemical relations in plants with its addition.

Starch

It is seen (Table 1) that per cent of starch had a tendency to decrease at high NPK levels. Among the treatments, combination of FYM with NPK showed the highest per cent of starch and the least content of starch was exhibited in control. The rest of the treatments had a similar influence on starch content. Reduced corn starch due to N manuring as noticed here, was also earlier reported.

Total carbohydrates

Considering the total carbohydrate (Table 1) it is the FYM treated plot that tended to favour higher accumulation of total carbohydrates.

Phenols

It is gratifying that FYM treatment could ensure a higher accumulation of this in the grain in tune with what has been observed for protein, starch, etc. The control and K elimination accounted for a significant reduction in this parameters. The other treatments remaining on par. This trend of result was supported by Srivastava and Mehrotra (1991).

From the foregoing, it becomes apparent that the FYM treatment possesses an over-riding beneficial effect in producing maize grain of better quality. The absence of addition of any fertilizer, elimination of S and K tend to decrease the grain quality marginally yet significantly.

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