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Evaluation of nutritional quality attributes and their inter-relationship in maize

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Abstract
The pot experiment was conducted in Department of Soil Science and Agricultural Chemistry. Annamalai University to evaluate the response of maize (*Zea mays* L.) with conventional, non – conventional organic source, industrial by-products combined with inorganic fertilizers. The treatments imposed were T_1-Control (100% RDF), T_2- 100% RDF + Municipal Solid Waste Compost @ 5 t ha^{-1}, T_3- 100% RDF + Municipal Solid Waste Compost @ 10 t ha^{-1}, T_4 – 100% RDF + Vermicompost @ 2.5 t ha^{-1}, T_5 – 100% RDF + Vermicompost @ 5 t ha^{-1}, T_6-100% RDF + Bagasse Ash @ 5 t ha^{-1}, T_7- 100% RDF + Bagasse Ash @ 10 t ha^{-1}, T_8- 100% RDF + Lignite Flyash @ 5 t ha^{-1}, T_9- 100% RDF + Lignite Flyash @ 10 t ha^{-1}.There were nine treatments combinations replicated thrice in CRD.

Keywords: Maize, Flyash, municipal waste, bagasse, vermicompost, starch, protein

Introduction
Maize (*Zea mays* L.) is the third most important cereal crops in the world after wheat and rice and known as "King of grain crops". Maize ranks as the major grain crop world wide. Maize, which is the only food cereal crop that can be grown in different seasons require moderate climate for growth. In India maize crop stand up as the third cash crop after wheat and rice. Maize is not only used as human food and animal feed, but is as well commonly used in several other industries as a raw material (Hareesh *et al.* 2016) [4]. In India maize cultivation is taken up in an area of 8.69 million hectares with an annual production of 21.81 million tonnes (Agriculture statistics at a glance 2016) [1]. Composting is the controlled biological process to turning organic waste into soil conditioner. In nature, organic matter such as wood, paper, animal waste and plant material is decomposed by bacteria (Shamim Banu and Kanagasabai 2012). Vermicompost maintains a steady mineral balance, improves nutrient availability for rejuvenating the soil, in addition of reduction of pathogenic organisms too (Geeta Utekar and Hanamantrao Deshmukh 2016) [3]. The Lignite Flyash of NLC serves as supplementary source of essential plant nutrients and is also effective in the reclamation of waste degraded land and mine spoil (Saranraj 2015) [9]. Bagasse ash is a good source of micronutrients like Fe, Mn, Zn and Cu and also high concentration of P and K. (Dotaniya *et al.*, 2016) [2]. At household level and small level composting practices could be effective which needs the people's awareness. After composting, the final product obtained is called compost, which has very agricultural value. It is used as fertilizer (Health impact of solid waste 2017) [5].

Materials and Methods

Table 1: Methods of quality parameter analysis

S. No	Parameters	Methodology	References
1	Starch	Anthrone reagent	Sadasivam and Manickam (1992) [8]
2	Crude protein	Micro-Kjeldahl method	Jackson (1973) [6]

Starch (%)
100 mg of finely powdered grain sample was homogenized in hot 80 percent ethanol to extract sugars. The residue was retained after centrifuging and washing repeatedtly (3 times) with 80 percent hot ethanol till the washings gave no colour with anthrone reagent. To the dried residue, 5.0 ml of water and 6.5 ml of 52 percent perchloric acid was added. The extraction was done with fresh perchloric acid and centrifuge it. The procedure was repeated three times with fresh perchloric acid. Then working standards were prepared by using standard glucose solution. Add 4 ml of anthrone reagent.

Heat it in a boiling water bath. The intensity of colour can be read in spectrophotometer. (Sadasivam and Manickam 1992) [8].

Crude protein (%)

The oven dried seed was finely ground and powder was used to determine protein content. The nitrogen content in kernel was estimated by microkjeldahls method Di-acid extraction (Jackson, 1973) [6]. Then the percentage of nitrogen is multiplied by a factor 6.25 gives the crude protein percent in maize seed.

Results and Discussion

Starch content

The results recorded that the starch content of maize increased due to various treatments as compared to control (Table 2). The treatments did not significantly influenced the starch content (%). The treatment which received 100% RDF + Vermicompost @ 5 t ha^{-1} (T_5) recorded highest value of 72.9 percent. This was followed by the treatments T_4, T_3, T_2, T_9, T_8, T_7 and T_6 registered 72.7, 72.5, 72.4, 72.3, 72.2, 71.7 and 71.5 percent stand next in order. The lowest starch content value of 71.1 percent was recorded in control (T_1) treatment.

Crude protein

The effect due to the application of industrial by-products, conventional and non-conventional organic sources in increasing the crude protein content was non-significant (Table 2). The highest crude protein content of 11.3% was recorded in the treatment T_5, T_4, T_3 and T_2. This was followed by the treatments T_8 and T_9 registered crude protein content 11.2%. The treatments T_6 and T_7 recorded the crude protein content as 11.1%. The treatment T_1 control recorded lowest value of crude protein content of 11.1%.

Table 2: Effect of conventional, non-conventional organic sources and industrial by-products on quality parameters.

Treatments	Starch content	Crude protein
	(%)	
T_1 - Control 100% RDF	71.1	11.1
T_2 - 100% RDF + Municipal Solid Waste Compost @ 5 t ha^{-1}	72.4	11.3
T_3 - 100% RDF + Municipal Solid Waste Compost @ 10 t ha^{-1}	72.5	11.3
T_4 - 100% RDF + Vermicompost @ 2.5 t ha^{-1}	72.7	11.3
T_5 - 100% RDF + Vermicompost @ 5 t ha^{-1}	72.9	11.3
T_6 - 100% RDF + Bagasse Ash @ 5 t ha^{-1}	71.5	11.1
T_7 - 100% RDF + Bagasse Ash @ 10 t ha^{-1}	71.7	11.1
T_8 - 100% RDF + Lignite Flyash @ 5 t ha^{-1}	72.2	11.2
T_9 - 100% RDF + Lignite Flyash @ 10 t ha^{-1}	72.3	11.2
Mean	72.2	11.2
S.Ed.	1.755	0.278
CD (p = 0.05)	NS	NS

The highest value of starch content (72.9%) and crude protein (11.3%) registered due to application of 100% RDF + Vermicompost @ 5 t ha^{-1} (T_5).This could also be explained on the basis of better availability of desired and required nutrients in crop root zone and from its solubilization cause by the organic acid produced from the decaying organic matter and also the increase uptake by maize and enhanced photosynthetic and metabolic activity resulting in better partitioning of photosynthesis sinks, which reflected in quality enhancement in terms of starch and crude protein content (Jinjala *et al.* 2016) [7].

Conclusion

Considering the salient findings in perspective, the study revealed that application of 100% RDF with Vermicompost @ 5 t ha^{-1} (T_5) was found to be best combination for maximizing the quality parameters of maize.

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