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Studies on the Germination and Metabolism of Sorghum seeds treated with Carbendazim

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ABSTRACT

The effect of fungicide carbendazim on germination and other morphological parameters was major aim of the study. For the germination experiments, seeds of sorghum were treated with recommended concentration of Carbendazim 0.2%, 0.3% and 0.1% as well as a water treated control. The results showed that the fresh weight of the leaves of the treated seeds increased in all the concentrations and the protein content also expressed similar results in all the concentrations. The results of the "t" Test were subjected to ANOVA and Tukey's test to understand the significance of the parameters tested. The fresh weight of the leaves were significantly influenced by the fungicide in all the concentration and the significance was seen at <.01. Similarly, the Protein ratio was analyzed and it showed the direct relation with each other concentration and significance percent was found to be <0.1.

KEYWORDS: Sorghum bicolor, Carbendazim, ANOVA, Tukey's test.

Introduction:

Sorghum (S. bicolor) is the most important millet crop occupying largest area among the cereals next to rice. It is mainly grown for its grain and fodder. Alternative uses of Sorghum include commercial utilization of grain in food industry and utilization of stalk for the production of value-added products like ethanol, syrup and jaggery and bioenriched bagasse as a fodder and as a base material for cogeneration.similarly, demand for industrial and potable alcohol is continuously increasing. The use of grain as an alternate raw material for the production of potable alcohol is promising and receiving importance for use as biofuel. Sorghum [Sorghum bicolor (L) Moench] is cultivated in Karnataka, India over an area of 2,165,000 ha. Production of the order 1,638,000 tons. The crop is grown in southern Karnataka in April and May and harvested between August and September unlike in northern Karnataka where the rainy season starts during June- July period. Sorghum is mostly grown for grain as well as dual purpose for food and fodder in certain areas of Mysore, Mandya and Chamarajanagar Districts. In southern Karnataka sorghum area has been increasing concurrent with the shrinkage of the other crops like cotton due to increased pest problems (Nageshwar et al., 2006).

Several studies have shown adverse effects of fungicide on plants. Steward and Krikorion (1971) reported that carbonate derivatives of the fungicide Antrakol, used for control of tobacco mildew, not only speedup cell division, but also inhibit photosynthesis.

Many authors believe that application of such plant chemicals like fungicide causes stress in plants. The word stress includes responses of plants to detrimental factors like fungicides and extreme environmental factors (Selye, 1936: Edreva, 1998). Levitt (1980) classified stress factors in two main groups: Physicochemical and biotic factors.

Materials and Methods:

The Sorghum seeds were randomly selected from the seed lot and 10 seeds in a set were made. All the treatments were followed in triplicates. The Sorghum seeds were soaked in the fungicide of varied concentrations like 0.1%, 0.2% and 0.3%. The seeds were soaked for 24hrs and the seeds were allowed to germinate for 10 days. After the stipulated time of germination the Sorghum seeds were used for the studies of various morphological and biochemical parameters. All the methods were followed according to standard procedures (Nene and Thapliyal, 1993). The germinated seeds were analyzed for fresh weight and the variations in the fresh weight of treated seeds were measured. Seed protein of both treated and untreated was analyzed by Lowry's method.

The data obtained were subjected to ANOVA and tukey's Post Hoc test using an online calculator for correlated samples (http://vassarstats.net/anova1u.html). The Tukey's test will automatically perform if there is significant difference between means (HSD = the absolute difference between any two samples, means required for significance at the designated levels (0.05 or 0.01).

The present study aims to understand the influence of fungicide, Carbendazim on a Sorghum cultivar

Table 1: Effect of Carbendazim on morphological and biochemical parameters of Sorghum seeds.

Sl No	Parameters	Control	0.1	0.2	0.3
1	Fresh Weight (g)	1.33	1.53*	1.46*	1.75***
2	Total Proteins (mg/g)	0.53	0.85***	1.04**	1.02*

Table 2: Data output of ANOVA and Tukey's HSD test for Fresh weight.

The Tukey's HSD is the absolute (unsigned) difference between any two sample means required for significance at the designated level.

HSD [.05] =0.06; HSD [.01] =0.08
M1 vs M2 Control vs 0.1%:Significant P<.01.
M1 vs M3 Control vs 0.2%: Significant P<.01.
M1 vs M4 Control vs 0.3%: Significant P<.01.
M2 vs M3 0.1% vs 0.2%: Significant P<.05.
M2 vs M4 0.1% vs 0.3%: Significant P<.01.
M3 vs M4 0.2% vs 0.3%: Significant P<.01.

Table3: Data output of ANOVA and Tukey's HSD test for Proteins.

The Tukey's HSD is the absolute (unsigned) difference between any two sample means required for significance at the designated level.

HSD [.05] =0.22; HSD [.01] =0.31
M1 vs M2 Control vs 0.1%: Significant P<.01.
M1 vs M3 Control vs 0.2%: Significant P<.01.
M1 vs M4 Control vs 0.3%: Significant P<.01.

M2 vs M3 0.1% vs 0.2%: nonsignificant.
M2 vs M4 0.1% vs 0.3%: nonsignificant.
M3 vs M4 0.2% vs 0.3%: nonsignificant.

Results and Discussion.

The results of the data are presented in Table 1 and the data output is presented in Table 2 and Table3. The effects of fungicide on germination and metabolism were the major criterion for this study. The concentration of fungicide also plays the role in the germination and metabolism.

The fungicide carbendazim has a highly influence on the fresh weight of the Sorghum seedlings. The fresh weight of the sample includes leaf weight and root weight. The increase or decrease in these values is mainly due to the effect of fungicide on their metabolism. The fresh weight of the Sorghum seedlings was greatly influenced by the fungicide concentration. Fresh weight increased considerably. The results were similar to the effect of tricyclazole on Maize seeds. (Avinash, 2012). The root length fell significantly in all the concentrations. This

may indicate that the plants had adopted stress alleviation mechanism; hence there was no increase in the root length of the plants treated with fungicide. This is the positive effect exhibited by the fungicide on the germination of Sorghum seeds.

Similarly the effect of fungicide on protein content was also estimated. Significant results were observed and all the concentrations had significant controlling effect on germination and metabolism of the plants. The 0.2% concentrations vs 0.1% concentration did not exhibited significant results. The extent of the growth in response to stress correlated with the amount of proteins. Baker et al., 1988. An osmotic shock effect of systemic fungicide results in the release of protein and loss of membrane transport ability in the leaf cells (Amar and Reinhold, 1973)

Conclusion.

Analysis of morphological and biochemical parameters using the ANOVA and Tukey's HSD test provides the precise conclusion in the analysis of the data. From the output it is clear that the fresh weight and protein content are the parameters controlling the growth of the plant. In all the concentrations the fungicide had the positive effect on germination and metabolism of the Sorghum seeds.

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