

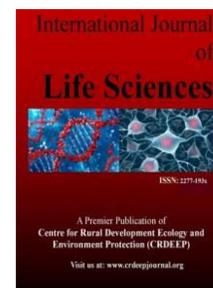
Vol. 10. No.2. 2021.

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International Journal of Life Sciences (ISSN: 2277-193x) CIF: 5.411; SJIF: 6.431
A Peer Reviewed Journal



Short Communication

Impact of Phytohormones on Physiological and Biochemical Processes in Aflatoxin B₁ treated Maize Seeds (*Zea mays* L.)

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Summary

The effects of 2 µg/g (2000 µg/kg) Concentration of AFB₁ and phytohormones (GA₃ and kinetin) alone and in combinations ratios (1 : 1, 1 : 2, 2 : 1, 1 : 3 and 3 : 1) have been studied on some physiological and biochemical changes viz., seed germination and seedling growth, chlorophyll and carotenoid contents, starch, sugar, protein, amino acids and nucleic acids contents as well as α-amylase activity and respiratory quotient (R.Q.) in maize (*Zea mays* L.) seeds. Madhuri – 01 variety of maize seeds obtained from reputed Scientific Seed house Kadirabad, Darbhanga, Bihar, India were used throughout the experiments.

The significant findings of the present investigations are as follows:

- (1) Mycotoxins (esp. AFB₁) : Inhibited seed germination and seedling growth, chlorophyll and carotenoid synthesis, sugar contents, α-amylase activity, Protein, Amino acid, Nucleic acid contents as well as R.Q. value. Starch level however, could not be degraded by the toxin treatments. Inhibition was reversed by AFB₁ with GA₃ and kinetin in various combination ratios, respectively.
- (2) Phytohormones (GA₃ & Kinetin) : Stimulated seed germination and seedling growth, chlorophyll and carotenoid syntheses, α-amylase activity, protein, amino acid, nucleic acid and for degradation of starch into simple sugars as well as R.Q. values. GA₃ was more effective than Kinetin.
- (3) The minimum and maximum inhibitions in seed germination were 12.00 and 79.00% in maize seeds due to AFB₁ at 2 µg/g concentration, whereas minimum inhibition (20.40 & 19.38%) were recorded at 1:3 combination of AFB₁ with GA₃ & kinetin, respectively.
- (4) Minimum and maximum inhibitions were recorded in root and shoot length i.e. 8.79 and 65.03%, 19.00 and 63.00% in maize seedlings due to treatment of AFB₁ at 2 µg/g concentration. Whereas minimum inhibition were observed at 1:3 combination of AFB₁ with GA₃ & kinetin, respectively.
- (5) The minimum inhibitions were recorded in Chl a, Chl b, Total chlorophyll and Carotenoid i.e. 16.00, 10.00, 12.00 and 28.00% and 18.00, 20.00, 19.00 and 35.00% in maize seeds due to treatment of AFB₁ with GA₃ and kinetin at 1:3 combination ratio, respectively.
- (6) The starch level was also influenced by these toxins. It was maximum i.e. 62.41 and 0.93% at 2 µg/g concentration of AFB₁ and GA₃ in maize seeds, respectively. The least amount of starch was recorded in phytohormones treated seeds where as the low levels of Starch i.e. 13.12 were recorded in maize seeds due to AFB₁ with Kinetin (at 2 µg/g) treatment, respectively.
- (7) The levels of TS, RS & NRS were 1.17, 0.29 & 2.40% in maize seeds due to treatment of AFB₁ with GA₃ at 2 µg/g concentration, respectively. The lesser amounts of TS, RS and NRS 0.71, 0.27 and 0.46% were recorded due to AFB₁ with kinetin treatment in comparison to AFB₁ with GA₃ in maize seeds, respectively.
- (8) AFB₁ reduced the α-amylase activity (increases in O.D. values) of germinating maize seeds. The optical density detected in control sets of maize seeds were 0.73, 0.34, 0.14% at 00, 30, 60 time interval, respectively; The maximum O.D. values i.e. 0.73 & 0.65 were observed in maize seeds due to AFB₁ with kinetin and GA₃ treatments, respectively.
- (9) Protein level was also depleted by 15.30, 30.24, 44.80, 62.15 and 73.44% by AFB₁ at the 100, 250, 500, 1000 and 2000 µg/kg concentration of the toxin treatment. These toxins and phytohormones combination were also exhibited maximum 61.79 and minimum 14.73% inhibition at their 3 : 1 & 1 : 3 combination ratios of AFB₁ with GA₃, respectively, where as the maximum inhibition i.e. 62.48 and minimum 15.97% at 3 : 1 and 1 : 3 combination ratios of AFB₁ with kinetin, respectively. The Gel electrophoresis results also revealed drastic changes in the protein profiles due to different concentrations and combinations of AFB₁ and Phytohormones.
- (10) DNA and RNA levels were inhibited by 58.24 and 53.49% due to 2000 µg/kg concentration of AFB₁. The maximum inhibition in DNA and RNA levels were 46.06 and 36.09% at 3 : 1 combination ratios of AFT-B₁ with GA₃, respectively where as the maximum

inhibition in DNA and RNA levels were 36.18 and 5.47% at 3 : 1 combination ratios of AFB1 with Kinetin, respectively. The maximum inhibition was reversed by the combination of AFB1 with phytohormones at 1:3 ratio, respectively. More or less similar results were recorded in DNA & RNA levels in maize seeds due to separate phytohormones treatments i.e. like control.

(11) Change in amino acid contents was evident in the toxin treated seeds. Inhibition in L-leucine and glutamic acid was 79.24 and 77.78% at 2000 µg/kg concentration of AFB1, respectively L-methionine, DL (+) Alanine and Aspartic acid were, How over completely lost at that concentration of AFB1. The maximum inhibition in L-Leucine and glutamic acid was 79.24 and 77.12% respectively at 3 : 1 ratios of AFB1 with GA3, respectively. More or less complete inhibition of L-Methionine, DL (+) Alanine and Aspartic acid were recorded at other combination ratios of AFB1 with GA3. Similar results were also recorded with the treatment of AFB1 with kinetin, respectively.

(12) The minimum R.Q. values i.e. 0.25 was recorded in maize seeds due to treatment of AFB1 at 2ug/g concentration whereas the higher R.Q. values i.e. 0.79 and 0.67% were observed in maize seeds due to AFB1 with GA3 and Kinetin treatments at 1:3 combination ratio, respectively.

On the basis of above results we suggest the use of Phytohormones(GA3 & Kinetin) for different crop plants under field conditions to achieve Quantitative improvements in the crop yield. Both GA3 and Kinetin have been shown to modify the metabolism of toxin treated seeds by breaking dormancy of seeds, increasing seedling growth, chlorophyll and carotenoid syntheses, Protein, Amino acid, nucleic acid, induction of α -amylase activity for degradation of starch into simpler sugars as well as increasing the R.Q. (Respiratory quotients values).

This will ultimately lead to the substantial financial returns to the growers as these Phytohormones are low priced and potential return to the grower is enormous.