# RESPONSE OF BIOFERTILIZERS ON ENZYMATIC ACTIVITIES OF GROUNDNUT (*ARACHIS HYPOGAEA* L. VAR TMV-7)

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**Abstract:** The field experiment was carried out the response of biofertilizers on enzymatic activities of groundnut. The present study revealed that the combined effect of biofertilizers (*Azotobacter* + *Mycorrhizae* + *Rhizobium*) showed significant effect than the control and other mono and dual inoculations. The enzyme activities such as peroxidase, polyphenol oxidase and catalase were gradually decrease from 0-35$^{th}$ day and then increase up to 56$^{th}$ day in all the inoculations.

**Keywords:** *Azotobacter*, Biofertilizers, Groundnut, *Mycorrhizae*, *Rhizobium*.

## INTRODUCTION

The biofertilizers are one of the sources as a part from supplying nutrients for the crops, conserve the environment from pollution as a result of excessive use of nitrogen (Mohamed and Ayman, 2009). Availability of nitrogen in *Sorghum vulgare* would have induced the formation of protein and enzymes in adequate quantities, which would have acted on the metabolities in the leaves and stems enhancing their conversion, transportation and accumulation in the seeds (Tisdale and Nelson, 1975). Catalase, peroxidase and polyphenol oxidase are all oxidative enzymes (Wang *et al*., 1991). Milda *et al*., (1987) reported that the forms of peroxidase are in inverse relationships with the 'growth and increase' during the development and senescence. Polyphenol oxidase comprises a large group of enzymes all of which are characterized by their ability to utilize molecular oxygen during the oxidation and phenolic substrates (Mayer and Harel, 1981). The present experiment was laid out the study, the response of biofertilizers on enzymatic activities of groundnut (*Arachis hypogaea* L. var TMV-7).

## MATERIALS AND METHODS

Seeds of groundnut (*Arachis hypogaea* L. var. TMV-7) obtained from Agriculture Extension Centre, Tirunelveli. The different biofertilizers (*Azotobacter*, *Mycorrhizae* and *Rhizobium*) were obtained from Tamilnadu Agriculture University, Coimbatore. In this experiments the biofertilizers were made into paste with cooled rice gruel, which was used for dressing of seeds. These seeds were dried under shade conditions for 24 hours. Seven types of inoculations were prepared. They were *Azotobacter*, *Mycorrhizae*, *Rhizobium*, *Azotobacter* + *Mycorrhizae*, *Azotobacter* + *Rhizobium*, *Mycorrhizae* + *Rhizobium*, *Azotobacter* + *Mycorrhizae* + *Rhizobium*. Control was maintained by soaking one set of seeds in distilled water. The experiment was carried out based on randomized complete block design with three replications. The experiment was done after the emergence of third leaf with regular intervals, till the senescence of third leaf. The enzymatic activities such as peroxidase, polyphenol oxidase and catalase were estimated by Kumar and Khan (1982) method.

## RESULTS

The results showed that biofertilizers had significantly effects on all the enzymatic activities. The enzymatic activities gradually decrease from 0 – 35$^{th}$ day and then increase upto 56$^{th}$ day in all the inoculations. Table - 1 exhibits the results of peroxidase activity on the 56$^{th}$ day, the control showed the minimum peroxidase activity it was 0.14 ± 0.001 mg/g and showed the maximum peroxidase activity, it was 0.44 ± 0.001 mg/g.

Table-2 exhibits the results of polyphenol oxidase activity. On the 56$^{th}$ day the control showed the lowest value of polyphenol oxidase activity ( 0.22 ± 0.006 mg/g) and the combined inoculation showed the highest value (0.38 ± 0.003 mg/g).

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The results of catalase activity tabulated in Table - 3. On the 56th day control showed the minimum activity (0.19 ± 0.002 mg/g) and the combined inoculation showed the maximum activity (0.42 ± 0.004 mg/g).

## DISCUSSION

In the present investigation, the combined application of biofertilizers treated groundnut plants showed a significant effect of enzymatic activities in all the treatments when compared to control and other mono and dual inoculations. This results were correlated with the work of Amal *et al*., (2010). The peroxidase activity was increased as a result of inoculation of *Pseudomonas* strains on *Sorghum bicolor* (Bala muralikrishnan *et al.,* 2005) and *Phaseolus vulgaris* (Sardi *et al*., 2006). *Arbuscular Mycorrhizae* inoculation also increased peroxidase and polyphenol oxidase activities in roots of *Moringa concanensis* (Jitendra and Anil, 2002). Increments in catalase enzyme activity were also detected by Stainer *et al*., (1997) when inoculated wheat plants with *Azotobacter*.

Increased polyphenol oxidase, phenyl alanine, ammonia lyase and peroxidase activity in Mycorrhizal plants which are responsible for the oxidation of phenolic compounds to quinines to inhibit pathogens growth is well documented (Raman *et al*., 2001).

In all the enzymatic activities decrease gradually 0 – 35th day and then increase upto 56th day. The result of present study showed the enzymatic activities (Peroxidase, polyphenol oxidase, and catalase) increases during the senescence. This results was correlated with the result of Sacher (1967).

**Table 1.** Response of biofertilizers on peroxidase content of *Arachis hypogaea* L. Var – TMV-7 (values in mg/g)

| **Days** | **Control** | ***Azotobacter*** | ***Mycorrhizae*** | ***Rhizobium*** | ***Azotobacter + Myzorrhizae*** | ***Azotobacter + Rhizobium*** | ***Rhizobium + Mycorrhizae*** | ***Azotobacter + Rhizobium + Mycorrhizae*** |
|---|---|---|---|---|---|---|---|---|
| 0 – 7 | 0.12 ± 0.002 | 0.15 ± 0.009 | 0.19 ± 0.006 | 0.20 ± 0.001 | 0.23 ± 0.001 | 0.25 ± 0.002 | 0.25 ± 0.004 | 0.29 ± 0.003 |
| 8 – 14 | 0.10 ± 0.001 | 0.12 ± 0.002 | 0.16 ± 0.002 | 0.18 ± 0.006 | 0.21 ± 0.008 | 0.22 ± 0.001 | 0.24 ± 0.009 | 0.26 ± 0.001 |
| 15 – 21 | 0.09 ± 0.002 | 0.11 ± 0.003 | 0.12 ± 0.001 | 0.16 ± 0.002 | 0.16 ± 0.001 | 0.19 ± 0.002 | 0.22 ± 0.006 | 0.24 ± 0.008 |
| 22 – 28 | 0.06 ± 0.003 | 0.10 ± 0.002 | 0.10 ± 0.001 | 0.13 ± 0.004 | 0.15 ± 0.006 | 0.17 ± 0.006 | 0.20 ± 0.009 | 0.21 ± 0.001 |
| 29 – 35 | 0.04 ± 0.008 | 0.07 ± 0.003 | 0.09 ± 0.006 | 0.11 ± 0.001 | 0.14 ± 0.002 | 0.16 ± 0.002 | 0.19 ± 0.006 | 0.20 ± 0.009 |
| 36 – 42 | 0.08 ± 0.001 | 0.11 ± 0.001 | 0.13 ± 0.002 | 0.17 ± 0.006 | 0.20 ± 0.004 | 0.23 ± 0.007 | 0.25 ± 0.008 | 0.26 ± 0.006 |
| 43 – 49 | 0.11 ± 0.006 | 0.16 ± 0.008 | 0.19 ± 0.001 | 0.20 ± 0.002 | 0.25 ± 0.003 | 0.29 ± 0.001 | 0.30 ± 0.004 | 0.36 ± 0.002 |
| 50 – 56 | 0.14 ± 0.001 | 0.19 ± 0.001 | 0.22 ± 0.002 | 0.26 ± 0.006 | 0.28 ± 0.009 | 0.36 ± 0.006 | 0.39 ± 0.004 | 0.44 ± 0.001 |

*O day = The day of emergence of 3rd leaf

**Table 2.** Response of biofertilizers on the polyphenol content of *Arachis hypogaea* L. Var – TMV-7 (values in mg/g)

| **Days** | **Control** | ***Azotobacter*** | ***Mycorrhizae*** | ***Rhizobium*** | ***Azotobacter + Myzorrhizae*** | ***Azotobacter + Rhizobium*** | ***Rhizobium + Mycorrhizae*** | ***Azotobacter + Rhizobium + Mycorrhizae*** |
|---|---|---|---|---|---|---|---|---|
| 0 – 7 | 0.18 ± 0.067 | 0.21 ± 0.084 | 0.22 ± 0.065 | 0.24 ± 0.044 | 0.27 ± 0.037 | 0.28 ± 0.041 | 0.30 ± 0.001 | 0.32 ± 0.053 |
| 8 – 14 | 0.15 ± 0.092 | 0.19 ± 0.030 | 0.21 ± 0.048 | 0.22 ± 0.061 | 0.25 ± 0.003 | 0.26 ± 0.055 | 0.29 ± 0.037 | 0.31 ± 0.046 |
| 15 – 21 | 0.13 ± 0.026 | 0.16 ± 0.010 | 0.19 ± 0.019 | 0.20 ± 0.024 | 0.23 ± 0.026 | 0.24 ± 0.053 | 0.27 ± 0.011 | 0.29 ± 0.092 |
| 22 – 28 | 0.11 ± 0.014 | 0.14 ± 0.029 | 0.17 ± 0.089 | 0.18 ± 0.043 | 0.21 ± 0.011 | 0.22 ± 0.008 | 0.25 ± 0.017 | 0.27 ± 0.009 |
| 29 – 35 | 0.09 ± 0.013 | 0.10 ± 0.036 | 0.14 ± 0.011 | 0.16 ± 0.024 | 0.19 ± 0.001 | 0.20 ± 0.028 | 0.23 ± 0.033 | 0.26 ± 0.006 |
| 36 – 42 | 0.15 ± 0.079 | 0.17 0.018 | 0.20 ± 0.065 | 0.22 ± 0.012 | 0.23 ± 0.040 | 0.26 ± 0.011 | 0.28 ± 0.001 | 0.30 ± 0.059 |
| 43 – 49 | 0.19 ± 0.014 | 0.20 ± 0.021 | 0.24 ± 0.033 | 0.25 ± 0.053 | 0.27 ± 0.004 | 0.27 ± 0.024 | 0.31 ± 0.019 | 0.33 ± 0.039 |
| 50 – 56 | 0.22 ± 0.015 | 0.24 ± 0.043 | 0.25 ± 0.006 | 0.27 ± 0.017 | 0.28 ± 0.070 | 0.30 ± 0.092 | 0.33 ± 0.043 | 0.38 ± 0.003 |

*O day = The day of emergence of 3$^{rd}$ leaf

**Table 3.** Response of biofertilizers on the catalase content of *Arachis hypogaea* L. Var – TMV-7 (values in mg/g)

| **Days** | **Control** | ***Azotobacter*** | ***Mycorrhizae*** | ***Rhizobium*** | ***Azotobacter + Myzorrhizae*** | ***Azotobacter + Rhizobium*** | ***Rhizobium + Mycorrhizae*** | ***Azotobacter + Rhizobium + Mycorrhizae*** |
|---|---|---|---|---|---|---|---|---|
| 0 – 7 | 0.17 ± 0.003 | 0.19 ± 0.001 | 0.20 ± 0.009 | 0.23 ± 0.002 | 0.24 ± 0.004 | 0.24 ± 0.001 | 0.26 ± 0.002 | 0.29 ± 0.003 |
| 8 – 14 | 0.16 ± 0.002 | 0.17 ± 0.007 | 0.19 ± 0.008 | 0.20 ± 0.006 | 0.22 ± 0.003 | 0.23 ± 0.001 | 0.25 ± 0.002 | 0.26 ± 0.004 |
| 15 – 21 | 0.14 ± 0.001 | 0.16 ± 0.008 | 0.17 ± 0.001 | 0.19 ± 0.002 | 0.21 ± 0.007 | 0.22 ± 0.002 | 0.23 ± 0.001 | 0.25 ± 0.001 |
| 22 – 28 | 0.11 ± 0.004 | 0.13 ± 0.003 | 0.15 ± 0.004 | 0.16 ± 0.001 | 0.19 ± 0.008 | 0.20 ± 0.004 | 0.20 ± 0.000 | 0.23 ± 0.001 |
| 29 – 35 | 0.09 ± 0.002 | 0.10 ± 0.010 | 0.12 ± 0.006 | 0.14 ± 0.003 | 0.17 ± 0.001 | 0.18 ± 0.002 | 0.19 ± 0.003 | 0.21 ± 0.010 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 36 – 42 | 0.13 ± 0.001 | 0.15 ± 0.001 | 0.16 ± 0.003 | 0.18 ± 0.002 | 0.21 ± 0.008 | 0.23 ± 0.006 | 0.26 ± 0.009 | 0.28 ± 0.001 |
| 43 – 49 | 0.16 ± 0.009 | 0.18 ± 0.002 | 0.20 ± 0.000 | 0.24 ± 0.002 | 0.27 ± 0.001 | 0.28 ± 0.003 | 0.30 ± 0.000 | 0.35 ± 0.001 |
| 50 – 56 | 0.19 ± 0.002 | 0.21 ± 0.001 | 0.24 ± 0.002 | 0.28 ± 0.008 | 0.31 ± 0.009 | 0.34 ± 0.002 | 0.38 ± 0.003 | 0.42 ± 0.004 |

*O day = The day of emergence of 3rd leaf

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