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# INFLUENCE OF *TRICHODERMA HARZIANUM* AND *AZOTOBACTER* ON DECOMPOSITION OF ORGANIC SUBSTANCES OF STRAW AND FLAX OF WHEAT IN TATARISTAN, RUSSIA

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**Abstract**

The study was carried to observe the effect of *Trichoderma harzianum* and *Azotobacter* on decomposition of organic substances of straw and flax in Tataristan Russia. The results indicated that the additional inoculation of cellulose decomposing microorganisms with straw and flax of wheat had increased the process of decomposition of organic substances. The sterilized and non sterilized straw and flax were used. *Trichoderma harzianum* in comparision to *Azotobacter* has shown high activity in non sterilized straw and flax.

**Keywords** *Trichoderma harzianum* and *Azotobacter*, in Tataristan Russia, in comparision to *Azotobacter*

## 1. Introduction

Adebowale *et al.*, (1989) from Microscopic examination of cell wall of Graminaceae during the microbial effect showed that some wall types and parts of individual walls are more easy to attack than other (Chesson A. *et al.*, 1986) At the farm level the use of ammonia treatment has not became economically successful (Devendra 1991).

*Azotobacte*r in soil is a cellulolytic diazotroph producing organism and with association of *Trichoderma* resulted in the utilization of plant residues as source of carbon and energy for nitrogen fixation. (Halsall *et al.*, 1986).

Therefore the biological method of straw treatment is an alternative to the chemical (Jackson 1978). The cellulose decomposing microorganism are widely distributed in nature which play important role in the process of conversion of organic substances and mineralization of soil components. Some of the important representative are *verticillium, Trichoderma, fusarium, Alternaria and Aspergillus.*

The cereal straw is the crop residues. It is the feed source of ruminant live stock in many countries. To improve the quality of straw for the good production of live stock is yet an important issue (Preston and being 1987).

In soil microorganisms get the carbon and energy from plant residues and the nitrogen fixation also take place with the decomposition of plant residues (Rice *et al.*, 1972). Straw was treated physically and chemically to improve its quality. (Sundstol 1974). Straw fractions are nodes, internodes and leaves. The ratio of these fractions depend upon the kind of species and environmental factors. Such as maturity at harvest, soil and climate conditions etc. The wheat straw has the different percentage of fraction as node 4-8, internode 54-73 and leaves 20-41(Shand *et al.*, 1988). Therefore the chemical composition of straw changes according to consequence (Theander 1984).

The chemical composition of leaves and nodes is similar that the hemicelluloses is more in both but internode has more cellulose. The silica is highest in leaves (DEs. Thiago *et al.*, 1982).

*Trichoderma harzianum* play role for nitrogen fixation by utilizing cellulose as a carbon and energy source. *Trichoderma harzianum* produce extra cellular enzyme called

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as cellulose and makes able the diazotroph to use cellulose as a carbon and energy source (veal *et al.*, 1984). The cell wall of straw contain amount of carbohydrates, small quantity of protein and minerals (walls *et al.*, 1988).

## 2. Material and Method

### Organism

*Trichoderma harzianum*, a cellulolytic fungus was isolated from green house of Tataristan Russia. Grown on Potato dextrose agar. The *Azotobacter* was obtained from the laboratory of the department of microbiology, Kazan state University of Russia. It is nitrogen fixing bacteria which promotes the soil fertility.

### Media

Stock cultures of *Trichoderma harzianum* were maintained on slopes of potato dextrose agar media. *Azotobacter* grown on *Azotobacter* basal media ($K_2$ $HPO_4$ 1.0g, $MgSO_4$ 0.2g NaCl 0.2g, $FeSO_4$ 0.005g Agar 15.0g tap water 900ml).

### Inocula Preparation

Plates of *Trichoderma harzianum* which showed good spore production after 12-18 days were used as inoculum. To each plate 10 ml of sterile distilled water containing 08-10 glass beeds were added and spore dislodged by gentle agitation. Than spore suspension was centrifuged (2000 rpm) for ten minutes. After that resuspended in potassium phosphate buffer pH 7. Suspension (100µl) containing $1.5x10^7$ spores (Helber chamber count) was used to inoculate 100 ml of medium.

The colonies of *Azotobacter* were transferred from stock slopes to liquid medium (10ml) and incubated at 27°C for 24 hours. After that culture was centrifuged and re-suspended in Potassium phosphate buffer pH 7. The culture (100µL) containing approximately $3x10^7$ cells (Helber chamber count) was used to inoculate 100ml of medium.

### Method

2gm of sterilized and non sterilized straw and flax were placed in Petri plates separately, moistened with 2ml of nitrogen maintained solution and experiment was repeated nine times and then inoculated with two drops of fourteen days old suspension of fungal culture in every Petri plate and incubated at 22 °C up to seven days. The *Azotobacter* was also inoculated together, individually and repeated in same method. After incubation, dried and finally the decomposed mass was determined quantitatively.

## 3. Result and Discussion.

It was observed that inoculation in sterilized straw the *Trichoderma harzianum* increased the decomposition of straw organic substances. The *Trichoderma harzianum* showed 4% difference of decomposed in relationship of control. The quantity of decomposed substances was 72mg. In combination the decomposed effect was more that was 95 mg and percent was 5.2 in relation with control **(Tab-1)**.The non sterilized straw result was 152 mg of decomposed organic substances by *Trichoderma*. And its percentage was 8.2 with the relationship of control. In combination of *Azotobacter and Trichoderma* result was 115 mg of the decomposed organic substances the percentage was 6.2 with the relationship of control **(Table-2)**. In the sterilized flax the *Trichoderma harzianum* showed result of decomposed organic substances 70mg. It was the 37 percentage in the relationship of the control but in combination with *Azotobacter* the result was 123 mg. Which was the 6.8% in relationship of control **(Table-3).** In non-sterilized flax the result by *Trichoderma harzianum* was 95mg of the decomposed organic substance. It was 6.2 percent in the relationship of the control. In combination with the *Azotobacter* the result was 135 mg of decomposed organic substances. It was 9.1 Percent. 1 in the relationship of control **(Table-4).**

The results have the difference between sterilized and non sterilized straw and flax. In non sterilized straw, the combined decomposition result was more and also flax non sterilized result was more. The result had the difference between sterilized , non sterilized, combine and individual use *of Trichodrema harzianum*. It is due to the presence of own flora of straw and flax.In this work *Trichoderma harzianum* inoculated individually and in combination with *Azotobacter*. The aim to calculate the degradation of straw and flax by both organism, the method showed a new insight in to the mode of action. Finally our results are coin size with the results of (Weimar *et al.*, 1985).

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**Table-1. Decomposition of organic substances of straw and flax after inoculation of *Trichoderma harzianum and Azotobacter.***

| Inoculation of straw and flax decomposing microorganism | Loss of mass after decomposition mg | Contents of organic substance in decomposed straw. mg | Quantity of decomposed organic substance. mg | Difference of decomposed substances in relation of control % |
|---|---|---|---|---|
| **STERILSED STRAW** | | | | |
| *Trichoderma harzianum* | 81 | 1780 | 72 | 4.0 |
| *Trachoderma harzianum and Azotobacteria* | 99 | 1757 | 95 | 5.2 |

**Table-2.**

| Inoculation of straw and flax decomposing microorganism | Loss of mass after decomposition mg | Contents of organic substance via decomposed straw. mg | Quantity of decomposed organic substance. mg | Difference of decomposed substances in relation of control % |
|---|---|---|---|---|
| **NON STERILSED STRAW** | | | | |
| *Trichoderma harzianum* | 174 | 1700 | 152 | 8.2 |
| *Trichoderma Azotobacter* | 128 | 1737 | 115 | 6.2 |
| **Control** | **90** | **1852** | **88** | **100** |

**Table-3**

| Inoculation of straw and flax decomposing microorganism | Loss of mass after decomposition mg | Contents of organic substance in decomposed straw. mg | Quantity of decomposed organic substance. mg | Difference of decomposed substances in relation of control % |
|---|---|---|---|---|
| **STERILSED FLAX** | | | | |
| *Trichoderma harzianum* | 81 | 1853 | 70 | 3.7 |
| *Trichoderma harzianum and Azotobacter* | 130 | 1800 | 123 | 6.8 |

**Table-4.**

| Inoculation of straw and flax decomposing microorganism | Loss of mass after decomposition mg | Contents of organic substance via decomposed straw. mg | Quantity of decomposed organic substance. mg | Difference of decomposed substances in relation of control % |
|---|---|---|---|---|
| **NON STERILSED FLAX** | | | | |
| *Trichoderma harzianum* | 88 | 1800 | 95 | 6.2 |
| *Trichoderma harzianumand Azotobacter* | 150 | 1740 | 135 | 9.1 |
| **Control** | **44** | **1923** | **42** | **100** |

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