

## Effect of Combined Application of Bio-Fertilizers along with FYM on Yield and Quality of Flue Cured Virginia Tobacco

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### Abstract

A field experiment was conducted for three years (2003, 2004 and 2005) during *kharif* seasons. The treatment consists of application of different rates of fertilizer N, FYM and bio-fertilizers such as *Azotobacter* and *Azospirillum*. Application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* resulted in higher cured leaf yield (1,315 kg/ha), TGE (769 kg/ha), net returns (Rs 20,780) and BCR (1.60) as compared to recommended package of practices. It was followed by application of 75% N + 2.5 kg *Azotobacter* + 2.5 t FYM and 5 t/ha FYM + 50% N + 2.5 kg each of *Azotobacter* and *Azospirillum*. Requirement of inorganic nitrogen of FCV tobacco can be reduced to an extent of 25% by combined application of *Azotobacter* and *Azospirillum* along with FYM.

**Key words :** *Azospirillum*, *Azotobacter*, Bio-fertilizer, FCV tobacco, Yield.

In Karnataka the Flue Cured Virginia (FCV) tobacco is cultivated in an area of around 0.70 lakh ha with annual production of around 80 million kg. Though grown in small area due to its good quality, it makes one of the important export materials and earns. Tobacco is grown as rainfed crop and among the several factors responsible for low yield in tobacco, inadequate and timely applications of fertilizer or manure and forced drought during crop season are the major ones. The crop growing soils has characters such as low nutrient and water holding capacity, low nutrient use efficiency. Fertilizer application plays a crucial role in our efforts to maintain buoyancy in production. Researchers emphasized that application of organic and inorganic is essential as a part of scientific management that helps in maintenance of soil health and production of the crop. As an INM component, use of organics not only assumes a safe supplementation of nutrients but also provides soil resilience. Use of bio-fertilizers known to fix a substantial amount of atmospheric nitrogen and supplies to the crop, enhances the fertilizer use efficiency, soil fertility status and ensures the partial saving of the nutrient, thereby helps in reducing the cost of cultivation. The response study for bio-fertilizers oriented integrated practices in tobacco is scanty. Hence the present investigation was carried out to assess the efficacy of bio-fertilizers, FYM and graded levels of Nitrogen fertilizer on yield of tobacco.

### Methods

Field experiment was conducted for three years (2003, 2004 and 2005) during *kharif* seasons at Zonal Agricultural Research Station, Shimoga. The soil of the experimental site was red sandy loam, slightly acidic in nature (pH 5.9), medium in organic carbon (0.48 to 0.62%), low in phosphorus (24 kg/ha) and potassium (112 kg/ha) status. The experiment was laid out on a randomized block design replicated three times. The treatment consists of application of different rates of fertilizer N, FYM and bio-agents such as *Azotobacter* and *Azospirillum*. The variety chosen for the study was Thrupthi (KST-19) and spaced at 90 × 60 cm. Each plot had size of 5.4 × 7.2 m. In each treatment N fertilizer was applied in two split doses first at planting and second at 30–35 days after transplanting. The recommended P and K (30 : 80 kg/ha) were applied common to all treatments, P at basal and K at two splits like nitrogen fertilizer. The bio-fertilizer is well mixed with farmyard manure and applied to the respective treatments as basal application only. Basal chemical fertilizers were given after 15 days of bio-fertilization. The leaf harvest was done in a phased manner starting from August to November in each year. The rainfall of 730.8, 547.2 and 1,409.6 mm with 51, 67 and 83 rainy days were recorded respectively for 2003, 2004 and 2005. Observations on cured leaf yield and top grade equivalent yield were recorded.

**Table 1.** Combined effect of bio-fertilizers on cured leaf yield (kg/ha) of FCV tobacco.

Treatment	03-04	04-05	05-06	Pooled
RDF	1236	1142	1001	1101
RDF + <i>Azotobacter</i> (AZB) 2.5 kg	1246	1283	966	1186
RDF + <i>Azospirillum</i> (AZS) 2.5 kg	1335	1023	654	997
75% N + 2.5 kg AZB + 2.5 t FYM	<b>1369</b>	1357	949	1275
75% N + 2.5 kg AZS + 2.5 t FYM	1337	1225	856	1141
75% N + 2.5 kg AZB + 2.5 kg AZS + 2.5 t FYM	1343	<b>1523</b>	<b>1064</b>	<b>1315</b>
50% N + 5 kg AZB + 5 t FYM	1264	1115	891	1092
50% N + 5 kg AZS + 5 t FYM	1267	1192	845	1113
50% N + 5 kg AZS + 5 kg AZB + 5 t FYM	1336	1312	941	1209
SE ±	45.20	71.08	32.38	20.62
CD 5%	NS	211	94	58
CV (%)	6.02	9.90	10.80	11.82

The data recorded were statistically analyzed and were tested at 5% level of significance to interpret the treatment differences (1).

### Results and Discussion

The effect of combined application of bio-fertilizers on tobacco cured leaf yield is presented in Table 1. During all the years of study, application of recommended dose of fertilizers (RDF) recorded moderate cured leaf yield (1,101 kg/ha). Addition of *Azotobacter* further enhanced yields during 2003 and 2004 while the positive effect by addition of *Azospirillum* was observed only during 2003. These findings are in conformity with the findings of Zhang Jian Guo et al. (2). There was inconsistency in the effect of bio-fertilizer application along with recommended dose of fertilizer (RDF) mainly due to soil moisture retentivity and supply of inadequate organic matter. However, for

these soils, addition of *Azotobacter* was found to be better as it gave an additional leaf yield of 85 kg/ha (1,186 kg/ha). During 2003, the cured leaf yield did not differ due to different treatments. However, addition of *Azotobacter* or *Azospirillum* along with reduced dose of nitrogen did not reduce the yield, instead improved the yield levels might be due to supplementation of FYM with bio-fertilizers. Among the different treatments, application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* or *Azospirillum* or both recorded marginally higher yields. In the subsequent years of study, application of bio-fertilizers, FYM and chemical N application resulted in significant variation. During 2004, compared to RDF, reduction of nitrogen to 25% along with bio-fertilizers and FYM did not reduce the cured leaf yield. Further reduction in inorganic nitrogen to 50% with either of the bio-fertilizers and FYM reduced the yield levels. Presence of both bio-fertilizers has synergistic effect

**Table 2.** Combined effect of bio-fertilizers on TGE (kg/ha) of FCV tobacco.

Treatment	03-04	04-05	05-06	Pooled
RDF	639	625	515	580
RDF + <i>Azotobacter</i> (AZB) 2.5 kg	684	864	486	675
RDF + <i>Azospirillum</i> (AZS) 2.5 kg	671	827	330	588
75% N + 2.5 kg AZB + 2.5 t FYM	756	842	469	698
75% N + 2.5 kg AZS + 2.5 t FYM	773	736	434	649
75% N + 2.5 kg AZB + 2.5 kg AZS + 2.5 t FYM	810	933	556	769
50% N + 5 kg AZB + 5 t FYM	705	775	440	619
50% N + 5 kg AZS + 5 t FYM	695	816	446	673
50% N + 5 kg AZS + 5 kg AZB + 5 t FYM	799	797	463	660
SE ±	36.75	37.95	20.49	22.36
CD 5%	109	113	59	63
CV (%)	8.84	8.23	9.06	9.89

**Table 3.** Economics (mean of three years) of use of bio-fertilizers in FCV tobacco.

Treatment	Gross returns Rs/ha	Cost of cultivation Rs/ha	Net returns Rs/ha	B : C ratio
RDF	46242	32500	13742	1.42
RDF + <i>Azotobacter</i> (AZB) 2.5 kg	49812	32650	17162	1.53
RDF + <i>Azospirillum</i> (AZS) 2.5 kg	41874	32650	9224	1.28
75% N + 2.5 kg AZB + 2.5 t FYM	53550	34300	19250	1.56
75% N + 2.5 kg AZS + 2.5 t FYM	47922	34300	13622	1.40
75% N + 2.5 kg AZB + 2.5 kg AZS + 2.5 t FYM	55230	34450	20780	1.60
50% N + 5 kg AZB + 5 t FYM	45864	36100	9764	1.27
50% N + 5 kg AZS + 5 t FYM	47746	36100	11646	1.32
50% N + 5 kg AZS + 5 kg AZB + 5 t FYM	50778	36400	14378	1.40

in influencing the yield levels both at 75 and 50% N application. Application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* resulted significantly superior cured leaf yield (1,523 kg/ha). It was followed by application of 75% N + 2.5 kg *Azotobacter* + 2.5 t FYM (1,357 kg/ha) and 5 t/ha FYM + 50% N + 2.5 kg each of *Azotobacter* and *Azospirillum* (1,312 kg/ha). During 2005, addition of either of bio-fertilizers with 75 or 50% N did not sustain the yield levels to that of RDF. Application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* achieved cured leaf yield (1,064 kg/ha) to that of RDF (1,001 kg/ha). Based on three years data, application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* consistently performed better with 1,315 kg/ha. It recorded 19.43% higher yield than application of RDF (1,101 kg/ha) alone. This was followed by application of 5 t/ha FYM + 50% N + 5 kg each of *Azotobacter* and *Azospirillum* that recorded 9.80% higher than RDF. This indicates that part of inorganic nitrogen can be replaced by bio-fertilizers for obtaining same or higher yield levels. Bio-agents might attribute the better growth by production of growth promoting substances viz. IAA, GA and other phytohormones apart from nitrogen fixation (3—5).

Top grade equivalent is a proportion of bright leaves present in total leaves. Data (Table 2) indicates that during all the years of study, application of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* consistently recorded higher values and found significantly superior. By producing

769 kg/ha, it gave 32.58% proportion to its cured leaf yield. RDF recorded less top grade equivalent (580 kg/ha). A net return realized by application of RDF is Rs 13,742 with BCR of 1.42. Compared to this, maximum net return (Rs 20,780) was realized in the treatment of 2.5 t/ha FYM + 75% N + 2.5 kg each of *Azotobacter* and *Azospirillum* followed by 75% N + 2.5 kg AZB + 2.5 t FYM (Rs 19,250) with BC of 1.60 and 1.56 respectively.

#### Conclusion

It can be concluded that combined application of *Azotobacter* and *Azospirillum* along with FYC reduced the inorganic nitrogen requirement of FCV tobacco to an extent of 25%.

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