

## RESIDUAL EFFECT OF NITROGEN LEVELS, ORGANIC MANURES AND AZOTOBACTER INOCULATION IN MULTI-CUT OATS ON SUCCEEDING SORGHUM CROP

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### SUMMARY

Field experiments were carried out to study the residual effect of nitrogen levels, organic manures and *Azotobacter* inoculation in multi-cut oats on succeeding sorghum crop at Research Farm, CCS Haryana Agricultural University, Hisar. The experiment was laid out in split-plot design allocating four nitrogen levels (0, 40, 80 and 120 kg N/ha) and two inoculation levels (no inoculation and inoculation with *Azotobacter chroococcum*) in main plots and five levels of organic manures (control, FYM @ 5 t/ha, FYM @ 10 t/ha, vermicompost @ 5 t/ha and vermicompost @ 10 t/ha) in sub-plots, replicated thrice. Plant height, tiller number per m. r. l., green fodder and dry matter yields of sorghum were not influenced significantly by residual effect of inoculation. Application of organics during **kharif** season for oats exerted significant residual effect on succeeding sorghum crop in terms of growth and yield. Among five levels of organic manures, application of vermicompost @ 10 t/ha in oat produced significant effect on all the parameters in sorghum fodder and grain crop viz., growth parameters, yield attributes and yields which were statistically at par recorded in FYM @ 10 t/ha. This might be due to application of higher proportion of nutrients through organic sources in oats and its carry over effect on succeeding sorghum crop.

**Key words :** Residual effect, nitrogen, manures, *Azotobacter*, sorghum, oat

India supports nearly 20 per cent of the world's livestock being the leader in cattle (16%) and buffalo (5.5%) population. Deficiency in feed and fodder has been identified as one of the major components in achieving the desired level of livestock production (Devi *et al.*, 2014). Oats (*Avena sativa*) is the most important cereal forage crop grown during winter season and sorghum (*Sorghum bicolor*) is the most important **kharif** fodder crop of Haryana. As such these two crops make promising forage cropping system in order to make round the year availability of the fodder. As oats and sorghum are cultivated in succession to each other, the nutrient management in these crops should be done on cropping system basis.

In a cropping system, response of the component crop is influenced by the preceding crop and inputs applied to them (Patidar and Mali, 2002). Studies have reported that organic manures have significant residual effects on the soil and succeeding crop (Silva *et al.*, 2006). All the ingredients of organic

manures are biodegradable and its residual nutrient would persist in the soil. With these concerns, there may be a possibility to certain amount of nutrients left in soil which will have carry-over effect on succeeding crop.

The responses of the succeeding crops in a cropping system are influenced greatly by the preceding crops and the inputs applied therein. Therefore, recently greater emphasis is being laid on the cropping system as a whole rather than on the individual crops. In addition, organic manures and biofertilizers have carry-over effect on the succeeding crops. Around 30% of the applied nitrogen as manure may become available to the immediate crop and rest to the subsequent crops (Jamaval, 2006). Maintenance of soil fertility is important for obtaining higher and sustainable yield due to large turnover of nutrient in the soil-plant system.

Field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar during 2003-04 and 2004-05. The experiment was laid

out in split-plot design during **rabi** season in oats crop comprising four nitrogen levels (0, 40, 80 and 120 kg N/ha) and two bio-fertilizers (no inoculation and inoculation with *Azotobacter chroococcum*) levels in main plots and five levels of organic manures (control, FYM @ 5 t/ha, FYM @ 10 t/ha, vermicompost @ 5 t/ha and vermicompost @ 10 t/ha) in sub-plots, replicated thrice.

Chemical composition of farm yard manure and vermicompost (oven dry weight basis)

Components	Farm yard manure (%)		Vermicompost (%)	
	1st year	2nd year	1st year	2nd year
Nitrogen	0.60	0.64	1.30	1.25
Phosphorus	0.22	0.25	0.32	0.30
Potassium	0.60	0.60	0.62	0.60

Oats variety HJ-8 as seeding materials, farm yard manure and vermicompost as organic manure sources, urea (46% N) and DAP (18% N and 46% P<sub>2</sub>O<sub>5</sub>) as fertilizers and *Azotobacter* culture for inoculation were used as experimental materials during both the years. Inoculation of seed with *Azotobacter chroococcum* was done as per recommended method. One third dose of nitrogen was applied at sowing and second split was applied at 45 DAS. After taking one fodder cut at 75 DAS, third split of nitrogen was applied and oat crop was remanaged for grain production. After the harvest of grain oats, sorghum (HC-171) was sown to see the residual effects of different treatments in multi-cut oats on succeeding sorghum fodder. No treatment was applied in sorghum. Data were analyzed by following the standard procedure for ANOVA (Panse and Sukhatme, 1985).

#### Residual Effects of Nitrogen Levels on Sorghum Fodder

The growth characters of sorghum fodder i. e. plant height and number of tillers per metre row length were significantly influenced by residual effect of different nitrogen levels during both the years (Table 1). The increase was significant up to 80 kg N/ha. However, maximum plant height and number of tillers were recorded with 120 kg N/ha which were statistically at par with 80 kg N/ha. Significant response of these two growth parameters to applied dose of nitrogen might be due to adequate supply of nitrogen which resulted in better utilization of carbohydrates to form more protoplasm and cellular material rather than the deposition

The experimental soil was sandy loam in texture, low in available nitrogen (163 kg/ha) and phosphorus (8.4 kg/ha), medium in available potassium (329 kg/ha) and normal in reaction (pH 7.85). Both the crops were kept free from major insect-pests and diseases. Available N, P and K, organic carbon and soil pH were estimated following the standard procedures.

in thickening of cell wall.

Application of nitrogen in preceeding crop i. e. oats had significant carry-over effects on green fodder and dry matter yields of succeeding sorghum crop during both the years (Table 2). Both levels of nitrogen i. e. 80 and 120 kg N/ha were statistically at par with green fodder and dry matter yield, which showed superiority over lower level (40 kg/ha) and control. Higher green fodder and dry matter yields of sorghum were owing to better plant growth parameters as a result of improvement in soil conditions.

#### Residual Effect of Biofertilizer on Sorghum Fodder

The growth parameters of sorghum fodder i. e. plant height and number of tillers per metre row length (Table 1) were not affected significantly under inoculation with *Azotobacter* during both the years of experimentation. This might be due to that *Azotobacter* did not have long-term effect. Similar to growth parameters, green fodder and dry matter yields (Table 2) of sorghum at fodder harvest were not significantly influenced by inoculation during both the years.

#### Residual Effects of Organic Manures on Sorghum Fodder

Organic manures have significant residual effect on plant height and number of tillers per metre row length of sorghum fodder after harvest of oats crop during both the years of experimentation (Table 1). This might

TABLE 1

Residual effect of nitrogen, *Azotobacter* and organic manures on plant height (cm) and tiller number per metre row length of sorghum at fodder harvest

Treatment	Plant height (cm)		Tillers /m. r. l.		Green fodder yield (q/ha)		Dry matter yield (q/ha)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
<b>Nitrogen levels (kg/ha)</b>								
Control	243.49	197.29	23.57	29.97	159.93	203.1	37.62	39.12
40	263.42	212.30	25.83	32.30	173.07	221.69	41.54	42.14
80	281.14	238.35	27.40	38.99	208.45	318.60	50.80	75.20
120	285.55	241.94	28.12	39.63	211.72	315.91	51.93	76.67
C. D. (P=0.05)	12.86	9.64	1.12	3.29	12.30	15.24	1.10	2.99
<b>Biofertilizers</b>								
No inoculation	262.44	216.07	26.28	34.15	186.48	255.93	45.71	53.62
<i>Azotobacter</i> inoculation	272.36	226.87	24.18	34.29	189.59	274.72	40.75	58.51
C. D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS
<b>Organic manures</b>								
Control	251.02	209.60	25.36	31.55	169.18	229.10	41.53	48.80
5 t/ha FYM	265.78	219.26	25.65	34.11	184.96	251.98	44.87	53.87
10 t/ha FYM	277.63	229.66	27.26	36.95	199.60	292.05	48.56	66.25
5 t/ha vermicompost	267.95	222.06	26.36	35.21	187.08	254.99	45.25	54.25
10 t/ha vermicompost	280.61	232.79	27.52	39.29	203.09	297.10	49.42	68.21
C. D. (P=0.05)	2.31	3.12	0.13	1.11	2.01	3.01	1.51	4.49

NS—Not Significant.

be due to slow release of major and minor nutrients during entire season. These findings corroborate the results of Patidar and Mali (2002).

The various organic manures applied in oats crop had significant carry-over effects on green fodder and dry matter yields of succeeding sorghum crop during both the years of experimentation (Table 2). Higher yield of sorghum was owing to better plant growth as a result of improvement in soil physical and chemical properties and slow release for long duration of nutrients by decomposition in the treatments of organic manures (Devi *et al.*, 2010). Similar results were also reported by Patidar and Mali (2002).

## REFERENCES

Devi, U., K. P. Singh, Meena Sewhag, Suresh Kumar, and Sunil Kumar. 2010 : Effect of nitrogen levels, organic manures and *Azotobacter* inoculation on nutrient

- uptake of multi-cut oats. *Forage Res.*, **33** : 9-14.  
 Devi, U., K. P. Singh, Suresh Kumar, and Meena Sewhag. 2014 : Effect of nitrogen levels, organic manures and *Azotobacter* inoculation on yield and economics of multi-cut oats. *Forage Res.*, **40** : 36-43.  
 Jamaval, J. S. 2006 : Effect of integrated nutrient management in maize (*Zea mays*) on succeeding winter crops under rainfed conditions. *Indian J. Agron.*, **51** : 14-16.  
 Panse, V. G., and P. V. Sukhatme, 1985 : *Statistical Methods for Agricultural Workers*, 4th edn. ICAR, New Delhi.  
 Patidar, M., and A. L., Mali. 2002 : Residual effect of farm yard manure, fertilizer and biofertilizer on succeeding wheat (*Triticum aestivum*). *Indian J. Agron.*, **47** : 26-32.  
 Silva P. S., J. Silva, F. H. T. Oliveira, A. K. F. Sousa, and G. P. Duda, 2006 : Residual effect of cattle manure application on green ear yield and corn grain yield. *Hort. Brasi.*, **24** : 166-169.