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## Study of growth, yield and yield attributes in late sown wheat as affected by different nitrogen doses and cow based bio-enhancers

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### Abstract

A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* 2021-22 on loamy sand to study the influences of different nitrogen doses and cow based bio-enhancers in late sown wheat on growth, yield and yield attributes. Growth and yield attributes *viz.*, plant height (30, 60 DAS and at harvest), number of effective tillers per metre row length, length of spike, number of grains per spike, grain and straw yield were significantly higher with 100% RDN + *panchgavya* as foliar spray @ 3% at 30, 45 and 60. Nitrogen and phosphorus uptake by grain and straw were significantly higher with 100% RDN + *panchgavya* as foliar spray @ 3% at 30, 45 and 60 DAS. A economical data revealed that application of 100% RDN + *Panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS achieved the maximum gross realization (₹111638/ha) and net realization (₹65352/ha).

**Keywords:** Wheat, grain yield, straw yield, *panchgavya*, economical

### Introduction

Wheat [*Triticum aestivum* (L.) emend. Fiori & Paol.] is the most important staple food crop of the world and emerged as the backbone of India's food security. It is grown all over the world for its wider adaptability and high nutritive value. It is an important winter cereal contributing about 38% of the total food grain production in India.

In India, wheat is the second most important cereal crop after rice covering an area of 31.36 million hectares. Total annual production of wheat in India is 107.8 million tonnes with the productivity of 3.44 tonnes per hectare during 2020-22 (Anon. 2020-21) <sup>[1, 2]</sup>. India is the second largest wheat producer (Approximately 12 per cent World's wheat production) and consumer after China. In Gujarat, wheat is an important *rabi* crop and is grown almost throughout the state with 1.36 million hectares area under cultivation, total production of 4.37 million tonnes and an average yield of 3.20 tonnes per hectare during 2020-21 (Anon. 2020-21) <sup>[1, 2]</sup>. Whereas in the World, wheat is grown in an area of 220.83 million hectares with the production of 775.7 million tonnes and productivity of 3.51 tonnes per hectare (USDA, 2020-21).

### Material and Methods

A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* 2021-22 on loamy sand. The experiment was laid out in a randomized block design with four replications consisted of nine treatments *viz.*, 100% RDN (80 kg N/ha), 100% RDN + *panchgavya* as foliar spray @ 3% at 30, 45 and 60 DAS, 100% RDN + *jivamrut* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS, 100% RDN + *amrutpani* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS, 100% RDN + *sanjivak* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS, 75% RDN + *panchgavya* as foliar spray @ 3% at 30, 45 and 60 DAS, 75% RDN + *jivamrut* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS, 75% RDN + *amrutpani* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS, 75% RDN + *sanjivak* @ 500 l/ha with irrigation at sowing, 21 and 45 DAS.

### Results and Discussion

#### Effect on growth parameters

**Plant height:** The results (Table 1) indicated that plant height at 60 DAS (64.18 cm) and at harvest (82.85 cm) were recorded significantly higher with treatment T<sub>2</sub> (100% RDN +

*panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS) and remained at par with treatment T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>1</sub> and T<sub>6</sub>. Treatment T<sub>9</sub> (75% RDN + *sanjivak* @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS) recorded lower plant height at 60 DAS (56.03 cm) and at harvest (72.87 cm). It is clear from the results that, the cow based bio-enhancers effect significantly on plant height at 60 DAS and at harvest but application of *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS with 75% RDN significantly affected due to application of nutrients through foliar application of *panchagavya* enhanced the growth rate of plant since it contains the favorable macro and micro nutrients and growth promoting hormones and biofertilizers in liquid formulation. These results are in conformity with the findings of Gowthamchand *et al.* (2019) [3] and Sutar *et al.* (2019) [11]. Panchal *et al.* (2017) [6] reported that foliar application of *panchagavya* @ 4% at branching + flowering recorded significantly higher plant height of chickpea.

### Effect on yield attributes and yield

#### Number of effective tillers per metre row length

Among all the treatments, significantly higher number of effective tillers per metre row length (77.18) was recorded with 100% RDN + *panchagavya* as foliar spray @ 3% at 30,

45 and 60 DAS (T<sub>2</sub>). However, it was significantly at par with T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>1</sub> and T<sub>6</sub>, respectively during experimental study (Table 1).

Significant increased in number of effective tillers per metre row length with T<sub>2</sub> treatment due to increased in availability of all macro and micronutrients through foliar spray of *panchagavya* resulted better nutrient availability, have a positive effect on growth parameters like plant height, dry matter production and which might have resulted in better tillering. Several workers have observed similar results of increased number of effective tillers with application of integrated nutrient supply through chemical fertilizers and cow-based bio-enhancer like *panchagavya* (Pagar *et al.*, 2010 and Patel, 2012) [5, 7].

#### Length of spike (cm)

Significantly higher length of spike (9.03 cm) was recorded with T<sub>2</sub> *i.e.*, 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS (Table 1). However, it was remained at par with T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>1</sub> and T<sub>6</sub> during experimental study. This might due to favourable application of bioenhancer which better portioning of photosynthesis from source to sink might have resulted in higher length of spike. These results are collaborated with Pagar *et al.* (2010) [5].

**Table 1:** Plant height, Number of effective tillers per meter row length, Length of spike and Number of grains per spike as influenced by various treatments

Treatment	Plant height (cm)		No. of effective tillers per meter row length	Length of spike (cm)	No. of grains per spike
	60 DAS	At harvest			
T <sub>1</sub> 100% RDN	60.01	77.36	72.85	8.58	37.00
T <sub>2</sub> 100% RDN + <i>panchagavya</i> as foliar spray @ 3% at 30, 45 and 60 DAS	64.18	82.85	77.18	9.03	39.50
T <sub>3</sub> 100% RDN + <i>jivamrut</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	62.58	80.94	75.30	8.75	38.48
T <sub>4</sub> 100% RDN + <i>amrutpani</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	61.90	79.58	74.00	8.70	37.90
T <sub>5</sub> 100% RDN + <i>sanjivak</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	61.59	78.96	73.85	8.68	37.80
T <sub>6</sub> 75% RDN + <i>panchagavya</i> as foliar spray @ 3% at 30, 45 and 60 DAS	59.38	76.61	69.40	8.17	36.40
T <sub>7</sub> 75% RDN + <i>jivamrut</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	57.50	74.35	67.50	7.87	35.38
T <sub>8</sub> 75% RDN + <i>amrutpani</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	56.31	73.47	66.30	7.71	34.48
T <sub>9</sub> 75% RDN + <i>sanjivak</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	56.03	72.87	65.78	7.69	34.30
S.Em.±	1.87	2.24	2.70	0.31	1.15
C.D.(P=0.05)	5.44	6.55	7.88	0.92	3.35
C.V.%	6.22	5.79	7.57	7.50	6.24

#### Number of grains per spike

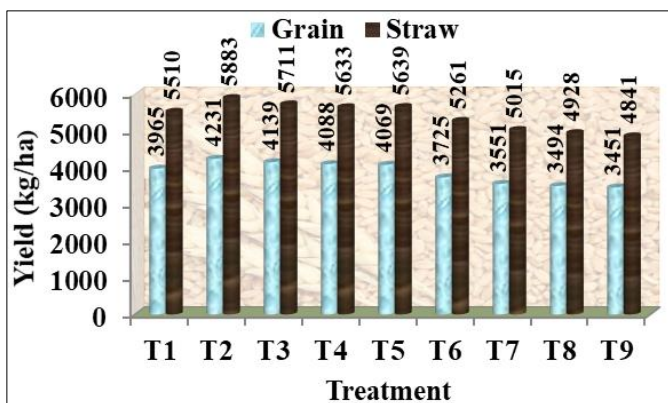
Among all the treatments, significantly higher number of grains per spike (39.50) was recorded with T<sub>2</sub> *i.e.*, 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS. However, it was significantly at par with T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>1</sub> and T<sub>6</sub>, respectively during experimental study. Lowest number of grains per spike (34.30) was noticed at T<sub>9</sub> treatment (75% RDN + *sanjivak* @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS).

#### Grain yield (kg/ha)

Grain yield of wheat was significantly higher with T<sub>2</sub> treatment *i.e.*, 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS (4231 kg/ha). However, grain yield recorded at T<sub>2</sub> treatment (Fig. 2) was found to be at par with T<sub>3</sub> (4139 kg/ha), T<sub>4</sub> (4088 kg/ha), T<sub>5</sub> (4069 kg/ha), T<sub>1</sub> (3725 kg/ha) during experimental study (Table 2). Lowest grain

yield (3451 kg/ha) was recorded with T<sub>9</sub>. The percentage increase in the grain yield was 6.70 per cent higher with application of 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS over 100% RDN.

The easy transfer of nutrients and growth stimulants to plants through foliar spray of optimum dose of *panchagavya* might be the reason for enhancement in plant growth and yield attributes. Smaller quantities of growth hormones like IAA and GA present in *panchagavya* when foliar fed, could have created stimulating in the plant system which in turn increased the production of growth regulator in cell system and the action in plant system stimulated the necessary growth and development of plant leading to higher yield. These results are in close conforming with those reported by Pagar *et al.* (2010) [5], Patel *et al.* (2013) [9], Yadav *et al.* (2016) [2], Panchal *et al.* (2017) [6], Patel *et al.* (2018) [8] and Gowthamchand *et al.* (2019) [3].



**Fig 1:** Grain yield and straw yield of wheat as influenced by various treatments

**Fig 2:** 100% RDN + *panchgavya* as foliar spray @ 3% at 30, 45 and 60 DAS (T2)

**Table 2:** Grain yield, straw yield and economics of wheat as influenced by various treatments

Treatment	Yield (kg/ha)		Gross realization (₹/ha)	Cost of cultivation (₹/ha)	Net realization (₹/ha)	BCR
	Grain	Straw				
T <sub>1</sub> 100% RDN	3965	5510	104544	42003	62540	2.49
T <sub>2</sub> 100% RDN + <i>panchgavya</i> as foliar spray @ 3% at 30, 45 and 60 DAS	4231	5883	111638	46286	65352	2.41
T <sub>3</sub> 100% RDN + <i>jivamrut</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	4139	5711	109058	48089	60969	2.27
T <sub>4</sub> 100% RDN + <i>amrutpani</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	4088	5633	108107	47123	60984	2.29
T <sub>5</sub> 100% RDN + <i>sanjivak</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	4069	5639	107254	49763	57490	2.16
T <sub>6</sub> 75% RDN + <i>panchgavya</i> as foliar spray @ 3% at 30, 45 and 60 DAS	3725	5261	97668	45823	51844	2.13
T <sub>7</sub> 75% RDN + <i>jivamrut</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	3551	5015	92964	47627	45337	1.95
T <sub>8</sub> 75% RDN + <i>amrutpani</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	3494	4928	91403	46661	44742	1.96
T <sub>9</sub> 75% RDN + <i>sanjivak</i> @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS	3451	4841	90171	49301	40870	1.83
S.E.m.±	197	246	-	-	-	-
C.D.(P=0.05)	576	719	-	-	-	-
C.V.%	10.24	9.15	-	-	-	-

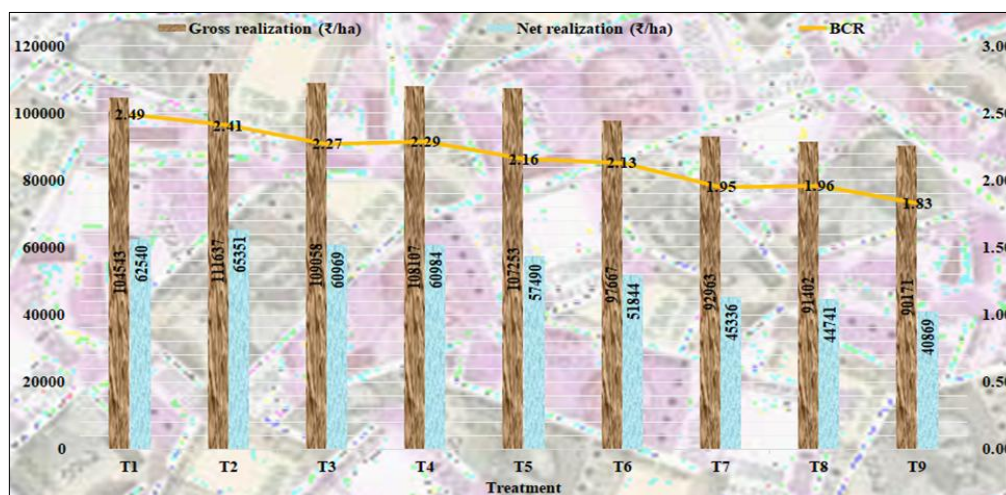
**Straw yield (kg/ha)**

Among all the treatments, 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS (T<sub>2</sub>) recorded significantly higher straw yield (5883 kg/ha) and it was found at par with T<sub>3</sub> (5711 kg/ha), T<sub>5</sub> (5639 kg/ha), T<sub>4</sub> (5633 kg/ha), T<sub>1</sub> and T<sub>6</sub> (5261 kg/ha), respectively (Table 2). The percentage increase in the straw yield was 6.76 percent higher with application of 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS over 100% RDN. The maximum improvement in biological yield with bionutrient sources might be associated with increased yield attributes due to concomitant increase in dry matter accumulation and supply

of all the plant nutrients. The findings closely followed the results of Patel (2012)<sup>[7]</sup>, Patel *et al.* (2013)<sup>[9]</sup>, Panchal *et al.* (2017)<sup>[6]</sup> and Jegoda *et al.* (2019)<sup>[4]</sup>.

**Effect on economics**

In present investigation of wheat, grain yield and straw yield were most affected economically. Considering the current market prices of grain and straw of wheat, different variable and non – variable inputs, cost of cultivation, gross realization, net realization along with benefit: cost ratio were calculated for various treatments are presented in Table 2 and graphically depicted in Figure 3.



**Fig 3:** Economics of wheat as influenced by various treatments

**Gross and net realization (□/ha)**

A perusal of data furnished in Table 2 revealed that application of 100% RDN + *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS (T<sub>2</sub>) achieved the maximum gross realization (□111638/ha) and net realization (□65352/ha). The lowest gross realization (□90171/ha) and net realization (□40870/ha) were noticed under T<sub>9</sub> treatment. These results corroborate the findings of Jegoda *et al.* (2019) [4] and Stalin *et al.* (2017) [10].

**Benefit: cost ratio (BCR)**

An appraisal of data on BCR indicated that the maximum BCR value (2.49) was observed with T<sub>1</sub> treatment *i.e.*, 100% RDN (T<sub>1</sub>) followed by the T<sub>2</sub> (2.41) and T<sub>4</sub> (2.29), respectively. The lowest BCR value (1.83) was noticed with treatment T<sub>9</sub> *i.e.*, 75% RDN + *sanjivak* @ 500 litre/ha with irrigation at sowing, 21 and 45 DAS.

**Conclusion**

From the results of one year of experimentation, it is concluded that late sown wheat should be fertilized with 75% recommended dose of nitrogen (60 kg N/ha) with *panchagavya* as foliar spray @ 3% at 30, 45 and 60 DAS along with 40 kg P<sub>2</sub>O<sub>5</sub> to obtain higher yield with 25% saving of nitrogen.

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