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Effect of different N levels and with Foliar Application of Nano Urea and Urea on Increasing Production and Productivity of Wheat

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Abstract: This study was performed to the evaluation of nitrogenous fertilizer with foliar spray of nanourea and urea on the wheat plant under irrigated conditions. An experiment was carried out in the*Rabi* season during 2021-2022 at a research farm, College of Agriculture ,Gwalior RVSKVV. The experiment was designed as a Randomized Block Design with thirteen treatments and replicated thrice. Studied traits included plant height, no. of ear head, test weight, biological yieldand seed yield. According to an analysis of variance, all treatments had significant effects on all studies traits. according to mean comparison, control (without N only) led to 44.4%, 41.7% and 40% reduction in seed yield compared to 100% RDN with two sprays of nano urea, 75% RDN with two sprays of nano urea and 100% RDN with one spray of nano urea, respectively. in conclusion, application of 50% RDN with two sprays of nano urea at tilllering and jointing stage could be increased seed yield and cut down 130 kg urea/ha and statistically equivalent to 100% RDN with one and two spray of nano urea as well as with two sprays of urea (5%); and 75% RDN with one and two sprays of nano urea as well as with two sprays of urea(5%).

Keywords: Nano urea, urea, foliar application, soil application, growth, yield

INTRODUCTION

Wheat (*Triticumaestivum*L.)is the prominent food grain crop in world and India and performs a crucial role in food and nutritional security. For about 20 per-cent of calories intake, around 55 per cent of the world's population fall under wheat. Wheat grain is one of the primefood grains ofIndia and a major foodof the people of North and central India, which people have choosen for Roti. Wheat is grown in 222.1 million hectares of area and production is registered 779.03 million tonnes (Source: USDA). India contributes 13.6% and 13.7% of the world's total wheat area and production, respectively. Further, wheat holds the first position in terms of global cereals acreage for the period 2021-2022. India obtained noticeable growth in wheat production during the last 50 years and is the second largest wheat producer in the world. The wheat production has increased 16 times at the time of independence (from 6.60 million tonnes to 106.84 million tonnes in 2021-22 @1.3milliontonnes/year). Wheat has been under cultivation in 30.54 million hectares during the 2021-22 *Rabi* season with an average productivity of 3484 kg/ha[1]

Among the wheat producing states, Madhya Pradesh accounted for the highest share of crop area and output estimated at 6.5 million hectares & 22.42 million tonnes (21%) respectively, after Uttar Pradesh. An average productivity of Madhya Pradesh is 3449 kg/ha (Source: DES, MoA & FW, India).

Improper use of N fertilizers and their low use efficiency resultant in polluting our environment (soil, water and air). N_2O greenhouse gase ia a prime reason of air pollution; NO_3 leaching cause in eutrophication and venomousness of our water

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bodies. In india, about Urea contributes about 82 per cent of the total fertilizer consumption. Fact that 70% of the urea used in agriculture field is wasted and remaining 30% actually makes it to the plant depends on a various of way from how you apply to the soil quality, that's why , we need to look at alternative solutions to conserve our agro-ecosystems for future generations. Nano Urea has come out as an innovative solution to overcome these concerns. It is said that a half bottle(500ml) of nano urea with better use efficiency can effectively reduce upto one bag (50 kg) of urea and because nano particles are so small and numerous, they have a lot more surface area relative to their volume, compared with the millimeter-size grains of urea that plants are exposedto—nearly10,000 times more in nitrogen. In the present study we compared the effect of soil applied graded doses of nitrogenous fertilizer alone and its integration with foliar spray of nano urea and urea the aim of this study was to investigate whether nutrition supply as foliar application and in the form a nano structure like nano urea can improve the growth, yield and nutrient use efficiency of wheat crop under irrigated condition.

MATERIALS AND METHODS

This researchtrial was operated at Farm, AICRP-Wheat, College ofAgriculture, RVSKVV,Gwalior during the *rabi* season of 2021-22. The region of the experimental site falls under the central zone of India and the soil of the research field was sandy clay loam in texture, slightly alkaline (pH 7.4) in reaction, low in organic carbon (0.46 %), nitrogen (180 kg ha^{-1}) and medium in available phosphorus (12.5 kg ha^{-1}) but high in potassium (200 kg ha^{-1}). The experiment consisted of 13 treatments as given below in table no.1 which were laid out in randomized block design (RBD) and replicated thrice. The wheat crop was sown on 15th November, 2021, The sowing was done using the normalized (adjusted considering 1000 grains weight as 38g) seed rate of 100kg/ ha at a row to row spacing of 20 cm with 4-5 cm depth. After pre-sowing irrigation, total 5 irrigations were applied during the whole growing period. The recommended dose of phosphorous and potassium i.e., 60 and 40 kg ha-1 were applied through SSP and MOP. But the total recommended dose of nitrogen i.e., 150 kg ha-1 was provided through the urea fertilizer . Nano urea and urea were applied in the form of spray solution as doses of 4ml/liter water and 5% solution, respectively. The first spray of nano urea and urea was given at tillering stage and the second at the jointing stage. All agronomic package and practices were followed as per recommended for the respective zones except nitrogen application.

RESULT AND DISCUSSION

Plant height and ear head per square meter

According to an analysis of variances, it was found that all treatments had significant effects on plant height and a number of earheads/m^2 at 5% statistical levels and also significantly higher than the control plot. Due to the increasing nitrogen dose, the plant received more nutrition for development and growth resulting increasing number of earheads/m^2.

At harvest, the application of 100% recommended dose of nitrogen along with two foliar sprays of nano urea at tillering and jointing stage registered the highest plant height and a maximum number of ear heads/m^2 which was at par with100% RDN along with one foliar spray of nano urea at tillering & also75 % RDN along with one and two foliar sprays of nanourea; at par with 75 % RDN along with two foliar sprays of nanourea, respectively. Though, all the levels of RDN (100,75 &50%) alone had significantly higher plant height and a number of ear heads/ m^2 over the control, these produced significantly lower plant height and number of ear heads/m^2 compared to all levels of RDN with foliar spray of nano urea and urea.

According to the mean comparison, the application of 100% recommended dose of nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nano urea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 22.45,26.02,27.93 and 24.63% increase in plant height and 20.5,29.32,34.93and 24.5% increase in a number of ear head per m^2.Application of 75% recommended dose of

nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nano urea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 17.84, 25.23, 26.54 and 23.92% increase in plant height and 17.06, 26.80, 32.18 and 21.87% increase in a number of ear head per m^2.application of 50 % recommended dose of nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nano urea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 13.31, 19.41, 22.97 and 18.79% increase in plant height and 13.74, 20.16, 23.25 and 17.63% increase in a number of ear head per m^2.

Test weight and Grains per ear head

Among the treatments, 100% RDN with two foliar applications of nano urea recorded significantly higher wheat test weight which was on par with 100% RDN with one foliar application of nano urea & with two foliar applications of urea and 75% RDN along with one & two foliar applications of nano urea as well as with two foliar applications of urea.According to the mean comparison, 100% RDN with one &two foliar applications of nano ureaand 75% RDN with one & two foliar applications of nano urea registered 3.3, 4.5, 3.12 & 3.51% higher test weight over control. All treatments significantly affected grains per ear head and registered significantly highest over control except 75% RDN and 50% RDN. The result [2] showed that the nano fertilizer composition possesses a number of desirable properties such as high solubility, stability, and controlled release with effective concentration, low toxicity, and ease of nutrient delivery, as nanoparticles have great potential to deliver nutrients to specific and targeted sites in living systems. The use of nanomaterials as carriers or wrappers for traditional fertilizers increases the ability to control the decomposition process

Seed yield and Biological yield

The seed yield of wheat was found significantly affected by nutrient treatments.The seed yield of wheat was found to be significantly highest in the 100% RDN with two sprays of nano urea and statistically equivalent to 100% RDN with one spray of nono urea & urea(5%); 75% RDN withone and two sprays of nano urea as well as withtwo sprays of urea(5%); and 50% RDN withtwo sprays of nano urea.

Even if, all the levels of RDN (100,75 &50%) alone significantly higher seed yieldover the control and according to the mean data led to 44.89, 37.36 & 28.5 % increase in seed yield respectively,over the control.

As per mean comparison, the application of 100% recommended dose of nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nanourea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 44.89, 58.33, 64.63 and 55.17% increase in seed yield; application of 75% recommended dose of nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nanourea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 37.36, 57.61, 60.75 and 47.96% increase in seed yield; application of 50% recommended dose of nitrogen alone and along with one foliar spray of nano urea at tillering stage, two foliar sprays of nano urea at tillering and jointing stage as well as two foliar sprays of urea (5%) at tillering and jointing stage led to 28.52, 50.4, 55.3 and 46.7% increase in seed yield over control.

Though, all the levels of RDN (100,75 &50%) alone significantly higher seed yield's over the control, these produced significantly lower seed yield compare to that all levels of RDN with foliar spray of nanourea and urea. Foliar application of nano urea increases the plants ability to absorb nitrogen as a result of its easy entry in to cells, in addition to its contribution to improving the activity of the photosynthesis process by increasing the content of plant leaves from chlorophyll and increasing the ability of crops to with stand various stress conditions and disease resistance[3]. The results of [4,5] in showed the superiority of nano fertilization in increasing growth and yield components of the wheat crop over those of urea fertilizer treatment. The result indicated that increased

Table 1: Growth, yield attributing characters as influenced by N doses with nano urea

S.N.	*Treatments*	*Plant height*	*Earhead/ sqm*	*1000 grain weight (g)*
1	Recommended N doses(1/3rd basal, 1/3rd CRI & 1/3rd tillering + water spray at tillering(40-45 DAS)and jointing(60-65 DAS)	93.80	350.67	42.93
2	Recommended N+One Spray of Nano Urea at tillering (40-45)	96.53	376.33	45.30
3	Recommended N+Two Spray of Nano Urea at tillering (40-45) and Jointing (60-65 DAS)	98.00	392.67	45.82
4	Rec N + Two Spray of Urea(5%) at tillering (40-45) and Jointing (60-65 DAS)	95.47	362.33	45.13
5	75% Rec N + water spray at tillering(40-45 DAS)and jointing(60-65 DAS)	90.27	340.67	42.93
6	75% Rec N + One Spray of Nano Urea at tillering (40-45)	95.93	369.00	45.19
7	75% Rec N + Two Spray of Nano Urea at tillering (40-45) and Jointing (60-65 DAS)	96.93	384.67	45.36
8	75% Rec N + Two Spray of Urea (5%) at tillering (40-45) and Jointing (60-65 DAS)	94.93	354.67	44.90
9	50% Rec N + water spray at tillering(40-45 DAS)	86.80	331.00	42.93
10	50% Rec N + One Spray of Nano Urea at tillering (40-45 DAS)	91.47	349.67	44.58
11	50% Rec N + Two Spray of Nano Urea at tillering (40-45 DAS) and Jointing (60-65 DAS)	94.20	358.67	44.63
12	50% Rec N + Two Spray of Urea (5%) at tillering (40-45 DAS) and Jointing (60-65 DAS)	91.00	342.33	44.23
13	Control(Without N only)	76.60	291.00	43.82
	Mean	92.46	354.13	44.44
	SEM	0.916	4.21	0.44
	CD (5%)	2.59	11.93	1.25

Table 2: Grains/earhead, Grain and Biomass yield as influenced by N doses with nano urea

S.N.	*Treatments*	***Grains/ earhead***	***Yield (Kg/ ha)***	***Biomass (Kg/ha)***
1	Recommended N doses(1/3rd basal, 1/3rd CRI & 1/3rd tillering + water spray at tillering(40-45 DAS)and jointing(60-65 DAS)	30.55	4622	12925
2	Recommended N+One Spray of Nano Urea at tillering (40-45)	32.74	5051	14456
3	Recommended N+Two Spray of Nano Urea at tillering (40-45) and Jointing (60-65 DAS)	30.47	5252	14286
4	Rec N + Two Spray of Urea(5%) at tillering (40-45) and Jointing (60-65 DAS)	33.15	4950	14000
5	75% Rec N + water spray at tillering(40-45 DAS)and jointing(60-65 DAS)	26.55	4382	13776
6	75% Rec N + One Spray of Nano Urea at tillering (40-45)	31.87	5028	15306
7	75% Rec N + Two Spray of Nano Urea at tillering (40-45) and Jointing (60-65 DAS)	32.24	5128	14626
8	75% Rec N + Two Spray of Urea (5%) at tillering (40-45) and Jointing (60-65 DAS)	27.92	4720	15306
9	50% Rec N + water spray at tillering(40-45 DAS)	26.55	4100	13605
10	50% Rec N + One Spray of Nano Urea at tillering (40-45 DAS)	29.30	4798	17449
11	50% Rec N + Two Spray of Nano Urea at tillering (40-45 DAS) and Jointing (60-65 DAS)	32.47	4956	14116
12	50% Rec N + Two Spray of Urea (5%) at tillering (40-45 DAS) and Jointing (60-65 DAS)	29.33	4680	13265
13	Control(Without N only)	25.11	3190	11565
	Mean	29.57	4622	14097
	SEM	1.00	124.6	256.71
	CD (5%)	2.83	352.5	726.2

levels of nitrogen fertilization along with a foliar spray of nano urea and urea led to an increase in plant height, a number of ear heads/m^2, test weight ultimate result as increased grain yield of wheat. These results are consistent with[6,7,8,4].

According to the mean comparison, the application of 100% recommended dose of nitrogen along with one& two foliar sprays of nano urea as well as two foliar sprays of urea (5%) led to 9.28, 13.63 &7.09% respectively, increase in seed yield; application of 75% recommended dose of nitrogen along with one& two foliar sprays of nano urea as well as two foliar spray of urea (5%) led to 8.78, 10.94 & 2.12% respectively, increase in seed yield; application of 50% recommended dose of nitrogen along with one& two foliar sprays of nano urea as well as two foliar sprays of urea (5%) led to 3.8, 7.2 & 1.25% respectively, increase in seed yield over 100% recommended dose of nitrogen .

According to the analysis of variances it was found that all treatments had significant effects on biological yieldat 5% statistical levels and also significantly higher than control plot.Significantly highest biomass yield was registered in the 50% RDN along with one foliar spray of nano urea followed by 75% RDN along with two foliar application of urea and one foliar application of nano urea. [9] showed the result of by absorbing light energy and converting it into carbohydrate compounds that are synthesized and accumulated with in plant tissue during the photosynthesis process, which is reflected in the increase in dry weight of the plant, and the availability of mineral and nano nitrogen plays a key role in encouraging the growth of vegetative and root system and making it more efficient in absorbing water and nutrients.

CONCLUSION

There were no significant differences on grain yield of wheat with an application of 100% RDN along with one & two foliar sprays of nano urea and 75% RDN along with one & two foliar sprays of nano ureabut were significantly affected by the application of 100% RDN. It indicates the application of 75% RDN along with one foliar spray of nano urea at tillering stage, reducing the amount of nitrogen fertilizer added to the wheat plant and increasing grain yield to 25% and 8.78% from the required amount of nitrogen (100% RDN) as a result its role in increasing efficiency of nitrogen and reducing the environmental pollution.

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