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RESEARCH

EFFECT OF NUTRIENT MANAGEMENT AND PLANT GROWTH REGULATORS ON YIELD AND YIELD ATTRIBUTES OF WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract: The present exploration entitled "Effect of nutrient management and plant growth regulators on growth and yield of Wheat(*Triticum aestivum* L.)" was carried out during *Rabi* season 2022-23 at Instructional farm, DKS College of Agriculture and Research station, Bhatapara (C.G.). The soil of the experimental site was clays in texture. The was laid out in randomized block design with three replications. Various growth parameters were measured at different stages of the wheat crop, and the results were analyzed. The results demonstrated a significant impact of nutrient management and PGR on various growth parameters of wheat. At 30, 60, 90 days after sowing, and at harvest, treatment T10 (75% RDF + Chlormequat chloride (Lihocin) @ 0.2 % + Tebuconazole @ 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) consistently exhibited the significant reduction in plant height. It also resulted in the maximum number of leaves and tillers at 30, 60, 90 days after sowing, and at harvest.treatment T_{10}(75% RDF + Chlormequat chloride (Lihocin) @ 0.2 % + Tebuconazole @ 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) showed the highest grain yield and straw yield at harvest, indicating its positive influence on the yield of wheat. The study also examined the dry matter accumulation, crop growth rate, relative growth rate, leaf area index, harvest index.Treatment T_{10}(75% RDF + Chlormequat chloride (Lihocin) @ 0.2 % + Tebuconazole @ 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) consistently showed the maximum values for these parameters at different stages of growth, suggesting its potential in enhancing wheat productivity followed by T_9(75% RDF + Chlormequat chloride (Lihocin) @ 0.2 % + Tebuconazole @ 0.1% at first node (35 DAS) & boot leaf stage (60 DAS).

Keywords: Chlormequat chloride (Lihocin), Nutrient management, *Triticum aestivum*, Tebuconazole

INTRODUCTION

Wheat (*Triticum aestivum* L.) the world's largest cereal crop belongs to Gramineae (*Poaceae*) family of the genus *Triticum*. The classification of the *Triticum* L. (wheat) genus is as follows: phylum: A*ngiospermatophyta*, class: *Monocotyledonopsida*, order: *Poales* (*Glumiflorae*) family: *Poaceae* (Gramineae), subfamily*: Pooideae*, tribe: *Triticeae*, subtribe: *Triticinae*, genus: *Triticum* L. Other genera in this subtribe are *Aegilops* L., *Amblyopy rum* (Jaub. & Spach) Eig, *Secale*L. (rye), *AgropyronGaertn*. (wheatgrass) and *Haynaldia* Schur. Wheat is consumed in a variety of ways such as bread, chapatti, porridge, flour, suji etc. The term 'Wheat' is derived from many different locations, specifically from English, German and Welsh languages. Wheat has good nutritional profile with 12.1 per cent protein, 1.8per cent lipids, 1.8per cent ash, 2.0per cent reducing sugars, 6.7per cent pentosans, 59.2per cent starch, 70per cent total carbohydrates and provides 314 K cal/100g of food. It is also good source of minerals and vitamins.

Globally, wheat is grown in about 220 million hectares holding the position of highest acreage among all crops with annual production hovering around 781 million tonnes. With a record average global productivity of 3543 $kgha^{-1}$ as per the estimates from the (Anonymous, 2019). In India, the crop is cultivated in 29.55 million hectares (13.43% of global area) to produce the all-time gargantuan output of 101.20 million tonnes (12.96% of world production) with a record average national productivity of 3533 $kgha^{-1}$.In Chhattisgarh state overall area under wheat production of 102.19 thousand hectare with the production 141.64 million tonnes and productivity of 1386 $kgha^{-1}$. Highest area of wheat is at Bemetara district with acreage of 15.28 thousand hectares with the production 16.68 million tonnesand productivity 1092 $kgha^{-1}$. In Balodabazar-Bhatapara district area under wheat production of 3.79 thousand hectares with the production 5.94 million tonnes and productivity 1567 $kgha^{-1}$ during 2017-18 (Anonymous, 2018).

One of the major problems faced by wheat growers in windy areas is growth behaviour of plants particularly excessive height which causes lodging of plants and thus induces large yield loss (Liu *et al*., 2014). This problem can be solved by using growth retardants to prevent the rapid increase of plant height, without any

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adverse effect on yield attributes and quality of crop. PGRs are chemical mixtures that suppress elongation or extension of crop internodes, thus reducing height and center of gravity height and improving other lodging traits to reduce the risk of lodging. Height reduction has been reported as an effect of PGRs by many researchers, (Okuno *et al*., 2014). Growth retardants are chemical substances that have the potential to alter structural or vital processes inside the plant by modifying hormone balance to increase yield, improve quality or facilitate harvesting through checking lodging especially in cereals (Zhang *et al*., 2017).

Chlormequat chloride or Cycocel belongs to the group of ammonium compounds and is one of the most frequently used plant growth moderators particularly in India and nowadays it is highly used to reduce lodging and to control vegetative growth of crops especially grain cereals.Folicur (tebuconazole) is a compound of triazole group which is known not only for its antifungal properties but also for inhibitory effect on stem elongation in certain crops. Application of Folicur during early stem extension reduces stem growth and lodging and increases canopy erectness and seed yield of crop before harvesting, significantly.

MATERIALS AND METHODS

A field experiment was carried out on rice during kharif season, 2022-23 at Instructional Farm, Alesur, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara (C.G.).

The experiment involving the cultivation of Wheat (*Triticum aestivum* L.) with the Ratan variety took place during the *Rabi*season of 2022-23. The study employed a Randomized Block Design to ensure accurate and unbiased results. The date of sowing the Wheat was recorded as 13/11/2022. The gross plot size was 6m × 5m, which equals 30 square meters, while the net plot size, where the actual experimentation occurred, was slightly smaller at 5.6m × 4m, equivalent to 22.4 square meters. In this experiment, there were 10 different treatments being tested, and each treatment was replicated three times, resulting in a total of 30 plots. To maintain separation between replications, a gap of 1 meter was left between them, and a gap of 0.50 meters separated each individual plot. The Recommended Dose of Fertilizer (RDF) used was 120 kg N, 60 kg P_2O_5, and 40 kg K_2O per hectare. The spacing between rows and plants was set at 20 cm × 5 cm (Row × Plant) and providing a comprehensive and controlled environment for studying the Ratan variety under various treatments and conditions.

RESULTS AND DISCUSSION

The field experiment was conducted during *Rabi*2022-23 at Instructional Farm, Dau Kalyan Singh College of Agriculture and Research Station, Bhatapara (Chhattisgarh.), entitled "Effect of nutrient management and plant growth regulators on growth and yield of Wheat (*Triticum aestivum* L.)" The result obtained are presented and discussed in this chapter under the following heads.

Ear length (cm)

Perusal of the data presented in Table 1 indicated that varying levels of RDF and PGR had significant effect on ear length. Application of 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_{10}) had maximum ear length (10.35) which was at par with 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_9) (9.54) was significantly superior over all other treatment. The smaller spike length was observed under absolute control (T_1) (7.05).

Due to the higher dose of RDF with growth regulators plant got higher nutrition for their development and growth which results in healthier growth of spike length.

Number of grains ear^{-1} head

Nutrient management and growth regulators were significantly affect on number ofgrains ear^{-1} at harvest of crop (Table 1).Application of 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_{10})produced maximum grain ear^{-1}which was at par with 75% RDF+ Chlormequat chloride 0.2% (T_6) (46.34), 75% RDF + Tebuconazole 0.1%(T_8) (48.63) and 50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1%(T_9)(49.40) was significantly superior over the other treatments and the lowest grain ear^{-1} (39.27) was observed under the treatment absolute control (T_1).

Higher dose of fertilizer and growth regulators resulted in number of grain and which finally gave the higher number of grain ear compared to other treatment. These results are in conformity with the finding of Goverdan *et al*., (2018).

Test weight (1000 seedweight in g)

Application of 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_{10})recordedsignificantly highest test weight (43.71) which was at par with 50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_9) (40.10) and significantly superior over the other treatments.Lowest test weight (34.07) was observed under the treatment absolute control (T_1).

Due to presence of 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% (T_{10}) crop showed the good response and result in higher test weight. These results were confirmed by the Nayak and Nadagouda (2015).

Grain yield (kg ha^{-1})

The results presented in Table no. 2 demonstrate the significant impact of PGR application on the grain yield of wheat. The findings indicate that the use of PGR,in combination with reduced doses of fertilizer had a substantial effect on the grain yield of wheat.

Applications 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T_{10}) had the higher grain

yield(4170 kg h^{-1}) which was followed by 50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T9) (3947 kg h^{-1}) and the lowest grain yield (2181 kg h^{-1}) was obtained under absolute control (T_1).

The grain yield was higher under 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T_{10}). which results in higher number of tiller and thus results in higher grain yield. Result have also been similar reported by Tripathi and Chauhan (2000).

Biological yield (kg ha^{-1})

The data shown in Table No. 2 demonstrate the considerable effect that applying PGR has on wheat biological yield. The results show that the application of PGR along with lower fertilizer dosages significantly increased the production of biomass of plant.

Nutrient management and PGR had significantly effect on biological yield of wheat.Application of 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T_{10}) (8930 kg h^{-1}) and followed by 50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T_9) (8436 kg h^{-1}) had the higher biological yield which was significantly superior over the other treatment and the lover biological yield was found under absolute control (T_1) (6101 kg h^{-1}).

Harvest index (%)

In relation to the overall biomass of the plant, the harvest index (HI), a crucial measure, indicates the percentage of crop biomass allotted to the edible or harvestable portion, such as grains. The information in Table No. 2 sheds important light on the wheat harvest index under various conditions, including the use of combined with RDF.

Among the treatments, treatment T5 (50% RDF + Chlormequat chloride 0.2% at first node (35 DAS) & boot leaf stage (60 DAS) showed the maximum harvest index of (47.34%) followed by 75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS) (T_{10}) (46.91%).However, treatment T1had a minimum harvest index of 35.23% This lower harvest index indicates the amount of biomass allotted to grain production in this treatment was comparatively smaller, which led to a lower yield of wheat that could be harvestedThis indicates that a significant portion of the total biomass produced by the wheat plants in this treatment was allocated to the formation of grains, contributing to a higher yield of harvestable wheat.

Table 1. Yield attributes of wheat as influence by nutrient management and plant growth regulators

	Treatment	1000 grain weight (g)	Length of ear (cm)	Number of grains ear^{-1}
T_1	Absolute control	34.07	7.05	39.27
T_2	50% RDF	35.97	7.50	41.33
T_3	75% RDF	37.63	8.47	42.04
T_4	100% RDF	39.75	8.85	45.07
T_5	50% RDF + Chlormequat chloride 0.2% at first node (35 DAS) & boot leaf stage (60 DAS)	35.61	8.36	43.50
T_6	75%RDF + Chlormequat chloride 0.2% at first node (35 DAS) & boot leaf stage (60 DAS)	36.46	8.73	46.34
T_7	50% RDF + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS)	37.78	8.26	47.00
T_8	75% RDF +Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS)	39.00	9.04	48.63
T_9	50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS)	40.10	9.54	49.40
T_{10}	75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at first node (35 DAS) & boot leaf stage (60 DAS	43.71	10.35	50.00
	SEm (±)	1.19	0.34	0.60
	CD (P=0.05)	3.52	1.02	1.77

Table 2. Yield and harvest index of wheat as influence by nutrient management and plant growth regulators

	Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
T_1	Absolute control	2181	3953.56	6101.45	35.23

T_2	50% RDF	2533	4107.87	6907.99	39.99
T_3	75% RDF	2869.02	4006.55	7175.74	41.56
T_4	100% RDF	3631.20	4160.46	7691.75	43.52
T_5	50% RDF + Chlormequat chloride 0.2% at first node (35 DAS) & boo leaf stage (60 DAS)	3483.40	3856.74	8240.08	47.34
T_6	75% RDF+ Chlormequat chloride 0.2% at first node (35 DAS) & boot lea stage (60 DAS)	3656.71	4165.37	8150.54	42.65
T_7	50% RDF + Tebuconazole at first node (35 DAS) & boot leaf stage (60 DAS)	3681.44	4264.22	7745.55	43.41
T_8	75% RDF + Tebuconazole at first node (35 DAS) & boot leaf stage (60 DAS)	3825.06	4371.93	8396.93	44.15
T_9	50% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at firs node (35 DAS) & boot leaf stage (6(DAS)	3947.86	4488.78	8436.44	45.77
T_{10}	75% RDF + Chlormequat chloride 0.2% + Tebuconazole 0.1% at firs node (35 DAS) & boot leaf stage (6(DAS)	4170.94	4633.57	8930.30	46.91
	Sem (±)	36.51	11.97	27.62	0.95
	CD (P=0.05)	108.48	35.55	82.06	2.82

CONCLUSION

The results showed that yield parameters viz., number of grain ear^{-1} head, weight of grain ear^{-1}, test weight as well as grain yield(4170 kg ha^{-1}), straw yield(4633 kg ha^{-1}) and harvest index (46.91) was found to be significantly superior under 75% RDF + Chlormequat chloride 0.2% Tebuconazole 0.1% (T_{10}) closely followed by 50% RDF + Chlormequat chloride 0.2% Tebuconazole 0.1% (T_9) treatment assigned yield advantage of over (3947 kg ha^{-1}) and (4488 kg ha^{-1}) in grain and straw yield respectively as compared to Absolute control treatment (T_1).

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