Biological Forum – An International Journal **(SI-AAEBSSD-2021) 13(3b): 274-279(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Yield Maximization of Newly State Released Wheat (*Triticum aestivum* L.) Varieties under Irrigated Condition

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(Received 01 July 2021, Accepted 30 September, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present investigation entitled "Yield maximization of newly state released wheat (*Triticum aestivum L.)* varieties under irrigated conditions" was carried out during *rabi* 2018-19 at the research farm, Barrister Thakur Chhedilal College of Agriculture and Research station, Bilaspur, Chhattisgarh. The experiment was comprised of different resource management practices (as main plot) with three newly release wheat varieties (as sub plot) and were laid out in split plot design with three replications. The treatments comprised of five resource management practices; i.e. T_1; (RPP), T_2; (RPP + 150% RDF + GR's), T_3; (RPP + 75% RDF + ST (consortia), T_4; [RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing(15cm)] and T_5; [RPP (No RDF) + ST + Soil T (consortia) + 1 HW] were taken as main plot and three varieties *i.e.* Chhattisgarh Genhu-3 (CG1013); (V_1), Chhattisgarh Genhu-4 (CG1015); (V_2) and Chhattisgarh Amber Wheat (CG1018); (V_3), were taken as sub plot.

The results revealed that the different resource management practices and wheat varieties significantly affected the plant stand, plant height, number of active leaves, number of tillers and dry matter production of wheat. Treatment T_4 recorded higher plant population, which was significantly superior to other treatment at 30 DAS and harvest. Irrespective of the treatments, plant height increased up to 90 DAS and slightly decline at harvest. At 30 DAS, T_2, produced the tallest plant, and at 90 DAS onwards, the application of T_4 produced tallest plant height. Among the varieties, at 30 DAS, Chhattisgarh Genhu 3 (V_1) recorded higher plant height and at 60, 90 DAS and at harvest Chhattisgarh Genhu 3 (V_1) produced tallest plant height. Almost similar trained were recorded for number of active leaves, dry matter production and number of tillers at all the growth stages of crop.

The higher crop growth rate was recorded at 30-60 DAS interval. At interval of 90 DAS – at harvest, treatment T_4 had the higher relative growth rate. Among the wheat varieties Chhattisgarh Genhu 3 (V_1) had the higher crop growth rate .The treatment T_4 recorded higher grain yield (48.18 q ha^{-1}) and the lowest grain yield was obtained under T_5. The application of T_4 also recorded higher straw yield (50.41 q ha^{-1}) which is statistically superior than others. Chhattisgarh Genhu 3 (V_1) was recorded higher grain and straw yield. The highest net profit (Rs. 54700) and benefit cost ratio was found under T_4 followed by application of T_1 and T_2. Among wheat varieties Chhattisgarh Genhu 3 (V_1) recorded highest net profit and benefit cost ratio next to Chhattisgarh Genhu 4 (V_2).

Keywords: Yield maximization, Resource management, Consortia, Vesta, Tebuconazole, Lihocin.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most important cereal crop in the world and stand next to rice in India. Wheat accounts for around 37 percent of total food grain production in India and occupies about 24 percent of the total food grain region. It is cultivated over an area of approximately 29 m ha in India. Nearly 82-85% of crop grown in India is irrigated, while the remaining is cultivated under rain-fed ecology.

Wheat recorded a highest production of 98.61 (000, t) in an area of 29.72 (000, ha) with the productivity of 33.18 q ha^{-1} in India (Anonymous, 2017-18). Uttar Pradesh is higher in production followed by Punjab, Madhya Pradesh and Rajasthan. In India four major wheat growing zones are their *i.e.*, North Western Plain Zone (NWPZ), North Eastern Plain Zone (NEPZ), Central Zone (CZ) and Peninsular Zone (PZ). At the current production level, North Western Plain Zone (NWPZ) alone produces over 50% of the total wheat followed by North Eastern Plain Zone (NEPZ) (less than half of NWPZ) and Central Zone. In which Chhattisgarh comes under Central zone and the state is spread over 13.51 m ha with a cultivable land of 5.38 m ha. Wheat occupies an area of about 0.88 (lakh, ha), with a production of 1.22 (lakh, t) and average productivity of 1386 kg ha^{-1} (Anonymous, 2017-18) where, wheat is cultivated as second crop after rice harvest under irrigated condition.

The state is categorized in three agro-climatic zones *i.e.*, Chhattisgarh plains, Bastar plateau and Northern hills, and in all the three zones, monocropping of rice in *kharif* is widely practiced. Plateau and hill zone are relatively cooler than the plain zone so they are more favorable for wheat production. Although, wheat area is more grown under Chhattisgarh plain zone as compare to Bastar plateau & Northern hill zone due to irrigation facilities available, athough the other zones have favorable climatic conditions *i.e.* cool and long winter as compare to Central plain zone, but the lack of irrigation facilities compalied the farmer to grown wheat under rainfed restricted irrigation conditions, delayed sowing of wheat after cultivation of medium to long duration rice.

Wheat is cultivated after harvest of rice and soybean in Chhattisgarh. Its average productivity (13.91 q ha^{-1}) of the state is very low compare to national productivity (29 q ha^{-1}). Many reasons are attributed to the lower productivity among these; old traditional method of cultivation, fixed rate of recommended dose of fertilizer, fixed time of application of fertilizer, inappropriate management of nutrient, is one of the major factor causing yield gaps (Majumdar *et al.,* 2012) different sowing method, irrigation interval, change in soil condition, change in weather type, unavailability of new wheat varieties which can perform well under the diverse climatic condition of state, late harvesting of *kharif* rice delaying the sowing of wheat which may lead to suffer drastic yield losses which may exceed up to 40-60%, lack of mechanization for harvesting of paddy followed by land preparation/sowing of wheat and late sowing of wheat with inadequate technical knowledge of package and practices.

The recommended package of practices followed from generation to generation for the cultivation of wheat were needed to be change according the present scenario for the higher demanding need of the production and productivity of wheat. It can be achieved by making various changes in the recommended dose of fertilizer, application of fertilizer according to the soil testing along with the incorporation of irrigation interval, changing seed rate, maintaining different spacing and better seed treatment and integrating nutrient management with biofertilizer and organic manure. To meet the requirement of nutrients, chemical fertilizers are the one option; but the use of chemicals in agriculture as input, deteriorate the soil health. Use of organic matter as source of plant nutrient increases the soil health fertilizer use efficiency and makes soil living. Chemical fertilizers increase crop yield over a short period but they do not maintain or sustain productivity due to various reasons like deterioration of soil structure, deficiency of micronutrient and disinfestations of soil microflora.

The use of organic materials on the other hand is a way, so that the soil is kept dynamic with living activities and in good health, at the same time keeping the environment clean, maintaining the economical balance and providing stability to the production level without polluting soil, water or air.

Wheat varieties recommended for cultivation (GW 322, GW366, HI 1544, DBW 110, Raj 4238 and many more) in Chhattisgarh are developed at Gujarat, Rajasthan, Haryana, and M.P are not performing well because they did not tested under the diverse climate of the state.

All India Co-ordinate wheat and barley improvement project (AICW&BIP) is under operation at Bilaspur centre and responsible for recommending the wheat production technologies and varieties for whole state. Bilaspur centre is located in plain zone has many differences in term of wheat production scenario from Northern Hills and Bastar plateau. Three centers namely Bilaspur, Ambikapur and Jagdalpur is rice based however, soybean-based wheat cultivation is prevailing in Kawardha.

During the last three years three varieties were developed under All India Co-ordinate wheat and barley improvement project (AICW&BIP) in Barrister Thakur Chhedilal College of Agriculture and Research Station Sarkanda, Bilaspur, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur center. They are Chhattisgarh Genhu 3 (CG 1013), Chhattisgarh Genhu 4 (CG 1015) and Chhattisgarh Amber Wheat (CG 1018).

Chhattisgarh Genhu 3 (CG 1013) - The average productivity of this variety is 59.3 q ha^{-1} under timely sown conditions, which is 7 % higher than the best check GW-322. This variety has good chapatti making quality, resistant to brown and black rust and has early maturity (119 days).

Chhattisgarh Genhu 4 (CG 1015) - The average productivity of this variety is 53.3 q ha^{-1} under late sown conditions, which is 4.71 % higher than the best check HD-2932. This variety has good chapatti making quality, resistant to brown and black rust and has early maturity (102 days).

Chhattisgarh Amber Wheat (CG 1018) - The average productivity of this variety is 41.6 q ha^{-1} under timely sown condition. This variety is excellent chapatti making quality and maturity at 127 days.

Now these varieties will go to the farmers' field. Logically all enterprising farmers would try to maximize their farm returns by allocating resources in an efficient manner. Although, expansion in wheat acerage cannot be a solution for production and productivity growth owing to the limited supply of land.

Work done at state, national and international level has provided interesting information about the various factors affecting the productivity of wheat for example seed rate, nutrient management, spacing etc. In the view of above facts, the present investigation was carried out to study the, Yield maximization of newly state released wheat (*Triticum aestivum* L.) varieties under irrigated condition.

MATERIALS AND METHODS

The experiment was conducted during *rabi*, 2018-19 at Instructional cum research farm of BTC College of Agriculture and Research Station, Bilaspur, Chhattisgarh India. Bilaspur is located at 22˚09' N latitude and 82˚15' E longitude and located at an altitude of 298 m above the mean sea level. The region falls under the Eastern plateau and hill region (Ago-climatic zone-7) of India. Chhattisgarh state is classified into three agro-climatic zones, of which Bilaspur comes under the Chhattisgarh plains zone of the state.

The soil texture, of experimental field was clay soil (Vertisols) locally known as kanhar. The soil was neutral in reaction. It had medium in organic carbon, low in nitrogen and medium in phosphorus and potassium contents.

The experiment was carried out in split-plot design with three replications. The treatments comprised with as main plot (five resource management practices) and sub plot (three wheat varieties). The treatment detail are five resource management practices (as main plot) T_1; RPP (Recommended package of practices); Two ploughing and rotavator, seed rate 100 kg ha^{-1} (adjusted seed rate considering 1000 grains weight as 38 g) seed treatment with Carbendazim + Mancozeb @ 5g kg^{-1} seed, 20 cm spacing, RDF (120:60:40 kg N, P_2O_5 and K_2O ha^{-1}), apply $1/3^{rd}$ nitrogen, full phosphorus and potash as basal and the remaining $2/3^{rd}$ nitrogen as $1/3^{rd}$ at first irrigation and $1/3^{rd}$ at second irrigation, apply 6 irrigation at critical stages and application of pre (Pendimethalin @ 2.5 – 3 litre ha^{-1}) and post [Vesta (Clodinafop Propargyl 15% + Metsulfuron Methyl 1% W.P. @ 60 g ha^{-1}] emergence herbicide. T_2; RPP + 50 % higher dose of RDF (180:90:60 kg N, P_2O_5 and K_2O ha^{-1}) + Chlormequat chloride (Lihocin) @ 0.2 % + Tebuconazole (Folicure 430 SC) @0.1 % of commercial product dose at first node (around 45 DAS) and Flag leaf (around 65

DAS) stages using 400 litre water ha^{-1} (Tank mix application).T_3; RPP + (– 25 % RDF, 90:45:30 kg N, P_2O_5 and K_2O ha^{-1}) + (- Seed treatment with Carbendazim and Mancozeb) + Consortia (Azotobacter + Trichoderma + Pseudomonas + PSB + KMB) Seed treatment, 10g each kg^{-1} seed. T_4;RPP + 25% higher dose of RDF (150:75:50 kg N, P_2O_5 and K_2O ha^{-1}) + Seed rate 25% extra (125 kg ha^{-1}) + Line spacing 15cm + Irrigation at 15 days interval.T_5;RPP (- RDF) + Seed treatment with Trichoderma + PSB + Azotobacter 10g each kg^{-1} seed + Consortia (Azotobacter + Trichoderma + Pseudomonas + PSB + KMB) Soil treatment 25 kg ha^{-1} with carrier of Vermicompost @ 5 tonnes ha^{-1} + 1 hand weeding at 25 DAS and three wheat varieties *i.e.* Chhattisgarh Genhu-3 (CG1013); (V_1), Chhattisgarh Genhu-4 (CG1015); (V_2) and Chhattisgarh Amber Wheat (CG1018); (V_3), were taken as sub plot. Regular biometric observations were recorded at periodic interval of 30, 60, 90 DAS and at harvest stage of selected plants. Growth parameters were recorded just before harvesting of crop. Harvesting was done when the spikes matured and plant was dried up. The grain yield of each plot was recorded was kg $plot^{-1}$ and then converted into q ha^{-1} after that threshing of the crop was done with thresher and straw was collected separately.

RESULT DISCUSSION

Effect on growth parameters. The result of the present study indicated that growth parameters of plant such as plant height, number of active leaves $plant^{-1}$, number of tillers (m^{-2}), dry matter accumulation (g $plant^{-1}$) of wheat crop was significantly influenced by different resource management practices and wheat varieties. Among the different resource management practices plant height was recorded were significantly affected the plant height at all the growth stages of crop. Irrespective of the treatments, plant height increased up to 90 DAS and slightly decline at harvest. At 30 DAS, among different resource management practices application of T_2 (RPP + 150% RDF + GR's) produced the tallest plant, which was significantly superior to other resource management practices. Further increase in crop age to 90 DAS onwards, the application of T_4 [RPP + 125% RDF + 125 kg seed ha^{-1} + spacing (15 cm)] produced tallest plant height which was significantly superior than treatments T_3 [RPP + 75% RDF + ST (Consortia)] and T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW]. The lowest plant height was observed under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] at all the growth stages of crop. Plant height was significantly increase at early stage (30 DAS) with increasing levels of inorganic fertilizers up to 150% RDF. The nitrogen plays a predominant role on plant growth and development, as it is constituent of all proteins and protoplasm of living cell. It promotes vegetative growth through cell enlargement, multiplication and increase the photosynthesis whereas, phosphorus plays pivotal role in energy and protein metabolism. It is also associated with increased root growth and early maturity of crop. While potassium is a leading element involves in photosynthesis, sugar formation, translocation of starch and synthesis of protein and amino acids. However in present experiment at early stage plant height was more T_2 because it received the higher dose of RDF which showed the positive effect towards the plant height and from 60, 90 DAS and harvest the plant height was higher at T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] because in T_2 (RPP + 150% RDF + GR's) we had applied the growth retardant which showed their effect and result in stunt height compared to T_4[RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] and T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] was also given the higher rate of RDF, which results in higher plant height. These results were confirmed by the findings of the Iqbal *et al*., (2012).

Number of active leaves at 60 DAS was more as compared to 30 DAS. Application of T_2 (RPP + 150% RDF + GR's) produced more number of active leaves at both the growth stages which was higher than T_1 (RPP),T3 [RPP + 75% RDF + ST (Consortia)] and T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] and at par with T_4 [RPP + 125% RDF + 125 kg seed ha^{-1} + spacing (15 cm)]. The lesser number of active leaves was observed under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] at both the growth stages of crop. More number of active leaves this might be due to the treatment got the higher dose of nutrient, among the nutrient nitrogen plays vital role to chlorophyll formation. Chlorophyll enables the plant to transfer energy from sunlight by photosynthesis. In turn, this influence cell size, leaf area and photosynthetic activity.

Different resource management practices at 30 and 60 DAS, application of T_2 (RPP + 150% RDF + GR's) produced the higher dry matter production, which was at par with T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)], T_1 (RPP) and T_3 [RPP + 75% RDF + ST (Consortia)]. At 90 DAS treatment T2 (RPP + 150% RDF + GR's) produced the higher dry matter production which was significantly superior than other resource management practices. Similar results were observed at harvest. Dry matter production under T_2 (RPP + 150% RDF + GR's) had the higher in all stages of growth this might be due to the plant received the enhanced availability of nutrient, helped in enhancing the leaf area resulting in a higher photo-assimilates and there by resulted in more dry matter production. Lowest dry matter production was observed under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] at all the stages.

Table 1: Effect of resource management practices and wheat varieties on plant height.

Treatments	Plant height, cm			
	30 DAS	60 DAS	90 DAS	At harvest
Resource management practices				
RPP (T_1)	22.55	69.40	93.58	94.42
RPP + 150% RDF + GR's (T_2)	25.80	68.70	90.47	91.02
RPP + 75% RDF + ST (consortia) (T_3)	20.84	65.59	88.13	87.51
RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing(15cm) (T_4)	23.50	72.75	96.68	95.96
RPP (No RDF)+ ST + Soil T (consortia) +1 HW (T_5)	17.05	59.10	84.80	83.71
SEm±	0.56	1.63	2.32	1.78
CD (P = 0.05)	1.85	5.39	7.67	5.91
Wheat Varieties				
Chhattisgarh Genhu 3 (V_1)	23.69	69.39	93.41	93.1
Chhattisgarh Genhu 4 (V_2)	21.59	67.13	90.59	90.32

Chhattisgarh Amber wheat (V_3)	20.58	64.81	88.2	88.15
SEm±	0.14	0.99	1.29	1.26
CD (P = 0.05)	0.42	2.93	3.84	3.75
Interaction (A×B)				
SEm±	0.32	2.21	2.89	3.14
CD (P = 0.05)	NS	NS	NS	NS

Table 2 : Effect of resource management practices and wheat varieties on number of active leaves.

Treatments	Number of active leaves, hill^{-1}/ plant^{-1}	
	30 DAS	60 DAS
Resource management practices		
RPP (T_1)	13.62	30.34
RPP + 150% RDF + GR's (T_2)	16.86	34.66
RPP + 75% RDF + ST (consortia) (T_3)	12.4	29.91
RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing(15cm) (T_4)	14.8	31.17
RPP (No RDF)+ ST + Soil T (consortia) + 1 HW (T_5)	11.83	29.18
SEm±	0.75	1.08
CD (P = 0.05)	2.49	3.57
Wheat Varieties		
Chhattisgarh Genhu 3 (V_1)	15.56	33.63
Chhattisgarh Genhu 4 (V_2)	13.82	30.51
Chhattisgarh Amber wheat (V_3)	12.33	29.01
SEm±	0.44	0.319
CD (P = 0.05)	1.31	0.947
Interaction (A×B)		
SEm±	0.98	0.71
CD (P = 0.05)	NS	NS

Table 3: Effect of resource management practices and wheat varieties on number of tillers.

Treatments	Numbers of tillers, m^{-2}			
	30 DAS	60 DAS	90 DAS	At Harvest
Resource management practices				
RPP (T1)	177.22	277.23	325.56	312.45
RPP + 150% RDF + GR's (T2)	183.19	333.19	384.45	378.45
RPP + 75% RDF + ST (consortia) (T3)	175.79	285.79	317.45	308.45
RPP + 125% RDF + 125 kg seed rate ha^{-1} +spacing(15cm) (T4)	211.5	361.57	413.32	398.29
RPP (No RDF)+ ST + Soil T (consortia) + 1 HW (T5)	171	180.34	192.34	187.34
SEm±	7.34	9.62	12.38	11.91
CD (P = 0.05)	24.32	31.87	41	39.45
Wheat Varieties				
Chhattisgarh Genhu 3 (V1)	186.14	290.59	331.11	322.31
Chhattisgarh Genhu 4 (V2)	183.76	287.4	328.43	320.9
Chhattisgarh Amber wheat (V3)	181.32	284.88	320.33	307.77
SEm±	2.95	5.19	5.92	5.83
CD (P = 0.05)	NS	NS	NS	NS
Interaction (A×B)				
SEm±	6.60	11.59	13.24	13.03
CD (P = 0.05)	NS	NS	NS	NS

Table 4 : Effect of resource management practices and wheat varieties on dry matter production.

Treatments	Dry matter production, g			
	30 DAS	60 DAS	90 DAS	At Harvest
Resource management practices				
RPP (T_1)	0.67	8.98	13.44	17.07
RPP + 150% RDF + GR's (T_2)	0.71	10.18	20.89	28.5
RPP + 75% RDF + ST (consortia) (T_3)	0.64	8.46	12.91	15.1
RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing(15cm) (T_4)	0.68	9.93	16.96	24.11
RPP (No RDF)+ ST + Soil T (consortia) + 1 HW (T_5)	0.54	6.86	10.65	12.67
SEm±	0.02	0.46	0.84	0.97
CD (P = 0.05)	0.08	1.53	2.78	3.22
Wheat Varieties				
Chhattisgarh Genhu 3 (V_1)	0.67	10.36	16.89	21.73
Chhattisgarh Genhu 4 (V_2)	0.65	8.73	14.99	19.57
Chhattisgarh Amber wheat (V_3)	0.63	7.56	13.03	17.18
SEm±	0.01	0.34	0.4	0.51

CD (P = 0.05)	0.03	1	1.19	1.51
Interaction (A×B)				
SEm±	0.018	0.75	0.89	1.14
CD (P = 0.05)	NS	NS	NS	NS

Effect on yield attributes. Yield attributes, which determine yield, is the resultant of the vegetative development of the plant. The data presented in Table revealed that effect of different resource management practices and wheat varieties on number of earheads, spike length, number of grains per earhead, weight of grains per earhead and 1000 seed weight of wheat was found significant. The different resource management practices T_4 [RPP + 125% RDF + 125 kg seed ha^{-1} + spacing (15 cm)] recorded the higher number of earheads, which was at par with T_2 (RPP + 150% RDF + GR's). This might be due to effect of closer spacing results in higher number of plant population and because of that had more number of tiller and which finally gave the higher number of earheads compared to other treatment. These results were confirmed by the Goverdan *et al*., (2018).The higher spike length was recorded under resource management practices of T_2 (RPP + 150% RDF + GR's), which was at par with T_1 (RPP) and T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] and statistically superior to T_3[RPP + 75% RDF + ST (Consortia)] this might be due to the higher dose of RDF plant got higher nutrition for their development and growth which results in healthier growth of spike length. The smaller spike length was observed under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW].The resource management practices T_1 (RPP) recorded higher number of grains ear^{-1} head, which was at par with T_2. The lowest number of grains ear^{-1}head was observed under resource management practices T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW]. These results were confirmed by the findings of Kale *et al.,* (2015); Patel *et al.,* (2018).The resource management practice T_4 [RPP + 125% RDF + 125 kg seed ha^{-1} + spacing (15 cm) was recorded higher weight of grains per earhead which was significantly superior than other resource management practices. The lowest weight of grains per earhead was found under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW]. Due to availability of higher dose of RDF in T_4 plant shows the positive effect toward their growth and development and leads to the higher weight of grain per earhead. These results were confirmed by the Nayak and Nadagouda (2015). The resource management practice T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] recorded the higher 1000 seed weight which was at par with resource management practice T_1 (RPP), T_2(RPP + 150% RDF + GR's) and resource management practice T_3 RPP + 75% RDF + ST (Consortia)]. The lowest1000 seed weight recorded under the resource management practice T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW].Due to higher dose of nutrients (125 % RDF) crop showed the good response and result in higher 1000 seed weight. These results were confirmed by the Nayak and Nadagouda (2015).

Table 5 : Effect of resource management practices and wheat varieties on yield attributes of wheat.

Treatments	1000 grains weight (gm)	Spike length (cm)	Number of earheads (m^{-2})	Number of grains ear^{-1} head (g)	Weight of grain ear^{-1} head (g)
Resource management practices					
RPP (T_1)	40.3	9.42	310.45	30.45	1.62
RPP + 150% RDF + GR's (T_2)	41.16	10.28	375.15	29.41	1.71
RPP + 75% RDF + ST (consortia) (T_3)	39.43	8.79	305.67	27.55	1.42
RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing (15cm) (T_4)	43.58	9.97	393.79	27.81	1.94
RPP (No RDF) + ST + Soil T (consortia) + 1 HW (T_5)	37.66	8.08	179.86	18.73	1.13
SEm±	1.05	0.43	10.91	1.44	0.05
CD (P = 0.05)	3.48	1.42	36.12	4.77	0.17
Wheat Varieties					
Chhattisgarh Genhu 3) (V_1)	42.42	9.9	318.75	27.34	1.58
Chhattisgarh Genhu 4) (V_2)	40.47	9.29	317.33	26.1	1.57
Chhattisgarh Amber wheat (V_3)	38.4	8.74	302.87	26.87	1.54
SEm±	0.7	0.19	5.16	0.7	0.03
CD (P = 0.05)	2.08	0.55	NS	NS	NS
Interaction (A×B)					
SEm±	1.56	0.42	11.54	1.55	0.075
CD (P = 0.05)	NS	NS	NS	NS	NS

Effect on yield. Grain yield straw yield was significantly influenced under different resource management practices and wheat varieties. T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] produced higher grain yield (48.18 qha^{-1}) which was at par with resource management practice T_2(RPP + 150% RDF + GR's) (45.04 q ha^{-1}). The lowest grain yield was obtained under resource management practice T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] (12.65 q ha^{-1}). The yield under lower nutrient level could not satisfy the crop need and ultimately resulted lower yield, this may be due to fact that supply of nutrients might held to meet the crop demand. The grain yield was higher under resource management practice T_4 due to the reason that this treatment got the higher 125% RDF, seed rate and closer spacing which results in higher plant population which followed with higher number of tiller and thus results in higher grain yield. These results were confirmed with the findings of the Tripathi and Chauhan (2000); Nayak and Nadagouda (2015); Kumar *et al.,* (2016). Resource management practices T_4 [RPP + 125% RDF + 125 kg seed ha^{-1}+ spacing (15 cm)] produced higher straw yield (50.41 q^{-1}ha) which was significantly superior over the other treatments and the lowest straw yield was observed under T_5 [RPP (No RDF) + ST + Soil T (Consortia) + 1HW] (14.95 q^{-1} ha). These results were confirmed by the findings of the Sharma *et al*., (2013) and Singh *et al*., (2016).

CONCLUSION

On the basis of results summarized above, it can be concluded that higher RDF and seed rate with minimum spacing performed better for growth parameters and yield attributing characters. An application of resource management practice T_4 [RPP + 125% RDF + 125 kg seed rate ha^{-1} + spacing(15cm)] gave highest plant height at 60, 90 DAS and at harvest as well as higher number of tillers was recorded at all stages of crop growth and also registered higher number of earhead, weight of grain ear^{-1} head, grain yield and straw yield.

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