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Research Paper

Assessment of Organic Minerals Suitability on the Biophysical Characters of Common Wheat, *Triticum aestivum* L. under Bundelkhand Region of Uttar Pradesh

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A B S T R A C T

An experiment has been conducted to assess the real time utility and abundance of organic minerals in cultivation of common wheat, *Triticum aestivum* L. in Bundelkhand region of Uttar Pradesh with the aim of finding the effect of available soil organic minerals on various biophysical or morphological characters including yield attributes. For the experiment, the cultivar namely RAJ-4037 which is best for dry land area and crop matures in 120 days. This variety is suitable for bakery and beverage industry, has been taken. The pre availability of manures were measured and the application of various fertilizers have been done as per the recommended dose for the cultivation. The data of various biophysical characters like height of Plants, number of tillers, leaf area index, number of ears, number of grains per ear and test weight have been recorded as per standard methods. The results revealed that organic minerals had a significant impact to influence the various biophysical traits such as height (65-87cm), number of tillers (273-315) while the maximum leaf area index was recorded maximum in vermin compost treatment.

***Key words*:** *Triticum aestivum*, Organic matter, Minerals, Morphological traits, Height, Weed

Among cereals consumed in India, wheat ranks second after rice and its production is increasing rapidly. Wheat is grown in India at a relatively high temperature than temperate climate with a short winter period. The minimum mean temperature of the coolest month, January in India ranges from 17-19°C. It is 1-2 degrees higher in December and February and 5-6 degrees higher in March and April [1]. Depending on altitude and mean temperature, [2] mentioned the winter of India as a hot environment in global perspective. The optimum time of wheat planting in India is 15-30 November for high grain yield. About 80-85% of wheat in India is planted after transplanting Aman rice and about 60% of wheat is planted late due to delayed harvesting of rice [3].

During grain filling stage of wheat, the late planted wheat often faces high-temperature stress, causing drastically yield reduction. There is a significant yield decline in India, at the rate of 1.3% per day when plant late instead of optimum time (15-30 November) [4]. The top research priority has given on heat stress for major wheat growing locations of the developing countries including India. Thus, in India major emphasis has been given to breeding late or terminal heat tolerant wheat cultivars in the national wheat breeding program [5]. Spot blotch or Bipolaris leaf blight (BpLB) caused by *Bipolaris sorokiniana* (teliomorph: *Cochliobolus sativus*) is the most devastating disease of wheat in India for its nature of damage and wide occurrence throughout the country. The pathogen also causes seedling blight, head blight and black point disease of wheat [6]. Under the agro-climatic conditions of India, late-sown wheat is affected more than the timely sown crop. The disease becomes more severe if the crop is lodged and rainfall occurs during grain filling period [7]. Leaf or brown rust caused by *Puccinia triticina* is also the most important disease of wheat in India. The disease usually appears in mid-February with increasing severity between mid and late March [8-9].

The nutrients when applied through organic sources provide better conditions for growth of weeds too. Moreover, the use of herbicide depletes the environment and has tendencies to live for a long time in soil and directly affect the human health. It affects adversely the physical and chemical properties of soil. It also decreases the microorganism in soil and ultimately the decomposition of crop residue takes more time. Particles of herbicides found in women milk which affects the growth and development of children. High dose of herbicide also pollutes the underground water that tends to different types of diseases in human body. Therefore, is it desirable to manage the weed through culture methods as organic farming weed control through use of herbicides is not allowed [10].

Considering the above issues, the organic farming appears to be better option to handle the emerging problems. Wheat being the important cereals crop grown in Bundelkhand with limited use of chemical fertilizer and pesticides [11]. However. the information on nutrient management through organic sources and weed management through cultural methods in wheat in general and for Bundelkhand in particular

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is meager or not available. therefore, present study was planned to know impact of organic minerals on biophysical attributes [12].

MATERIALS AND METHODS

Geographical location of the experimental site

The field experiment was laid out on "Organic Research Farm," Kargunaji, Bundelkhand University, Jhansi (Uttar Pradesh). This farm is situated behind the Bundelkhand University in foot hills of Kemashan Mata temple during *Rabi* seasons of 2017-18 and 2018-19.

Soil of experimental site

Five soil samples were collected randomly from different spots of the experimental field from 0-15 cm depth before the field preparation. The collected samples were dried in hot oven and then crushed and mixed. Later by dividing half and mixed again, the process was repeated and soil sample of 0.5 kg was taken for laboratory test. The samples were subjected to appropriate mechanical and chemical analysis to know its texture as well as initial fertility status.

The experiment was laid out in factorial randomized block design with three replications. Treatment involved in present investigation were three methods of weeding and four organic sources of N viz: vermicompost, poultry manure, city manure and FYM applied to supplement 100 kg N/ha as recommended. The twelve Treatment combinations were allotted in each experimental plot randomly and the following data have been recorded as per the standard methods:

1. Initial Plant population by visual counting
2. Plant height in cm
3. Number of Shoots or tiller
4. Leaf area index

RESULTS AND DISCUSSION

Initial plant population

The data pertaining to initial plant population were recorded at 20 days after sowing (DAS) and presented in (Table 1) reveal that initial plant population did not influence significantly due to organic source of N supplementation, weed control methods and their interaction effect. Different treatments and their interaction showed minor variations in plant population during both the years of study but it did not cross the level of significance.

Plant height (cm)

A cursory glance over the data presented in (Table 1) revel that the rate of growth of the plants was initially slow and brought maximum momentum between 30 to 90 DAS thereafter, the increase in growth was rather slow.

The various organic sources of N supplementation affected the plant height significantly at all the stages of crop growth except at 30 DAS. It differed significantly under various organic sources at 60 and 90 days after sowing. Maximum plant of (65.30 and 67.23 cm) and (86.03 and 87.93cm) was noted under application of vermicompost at 60 and 90 days after sowing during both the respective years of investigation which was non significantly followed by poultry manure and significantly followed by city manure and FYM. Height achieved by city manure and FYM treatment was also at par with each other. The minimum plant height was found with FYM application (M_4) *i.e.*, (55.20, 56.80) and (72.80, 74.47 cm) at 60 and 90 DAS, during both the years of investigation respectively. Beneficial effect of organic sources on plant height was also noted by [13-14].

Different weed control measures induced significant increase in plant height at various growth stages. Under uncontrolled weed treatment the plant height reduced significantly as compared to hand weeding treatment. Maximum plant height was noted under two hand weeding treatment followed by one hand weeding and control. The trend of data was similar during both the years of experimentation.

No significant interaction effect was noticed between organic sources of N and weed control methods at all the growth stage of the crop. These findings are in close conformity with the findings of [15] who reported that weeds associated with wheat crop reduced the grain yield by 25% as compared with weed free check. Weeds not only divest the crop of vital growth factors viz.; nutrients space, light and moisture but also hinder the germination and growth of crops and thereby results in heavy yield loss ranging from 10 to 50% in wheat [16].

Number of shoots m^{-2}

The data revealed that manifests that numbers of shoots m^{-2} did not significantly influence due sources of N supplementation at 30 DAS. This was mainly due to the fact that the number of shoots m^{-2} was counted at 30DAS and organic sources of N were applied up to entire crop. However, the effect of organic sources of N supplementation on no. of shoots m^{-2} at 60 DAS and 90 DAS was found to be significant. At 60 DAS the Vermi-compost being at par poultry manure, recorded maximum number of shoots m^{-2} (271.6, 276.20 during 2018 and 2019 respectively) which was significantly superior over city manure and FYM. At 90 DAS, the maximum and minimum number of shoots recorded was (315.19, 321.16) and (269.89, 273.46) with vermin-compost and city manure during first and second year, respectively. The beneficial impact of organic manures on physical, biological and chemical properties of soils is widely known but the full appreciation for the some remains largely ignored in commercial chemical agriculture. It is well known that organic manures are responsible to increase the nutrient holding capacity of soil and minimize the effect of toxicants. Organic manures make the soil biologically active as these are good source of food and energy for soil micro-organisms and increase the activity of microbes which bring non-available plant nutrients into available from [17] thus improving the growth, yield and quality of crop plants. Application of FYM to wheat induced better growth of plant which resulted in taller plant, more tiller m^{-2}, length of spike, grain weight $spike^{-1}$, test weight, yield of grain and straw over the control, increased plant height, higher number of tiller m^{-2} and increased the yield of wheat with the application of FYM [18].

Significant differences in number of shoots m^{-2} were observed when we move from W_2 (Two hand weeding at 25 and 45 DAS) to W_0 control at 30, 60 and 90 DAS. The maximum number of shoots m^{-2} were noticed under W_2 (Two hand weeding at 25 and 45 DAS) treatment which was significantly higher than W_1 (One hand weeding at 25 DAS) and W_0 (Control) at all stages of crop growth i.e., 30, 60 and 90 DAS. The minimum number of shoots m^{-2} was recorded with control treatment. Detrimental effect on growth of wheat was also noted by [19]. The interaction effect between organic sources of N supplementation and weed control treatment were found non- significant at all the growth stages of crop.

Leaf area index

Data pertaining to leaf area index of wheat as influenced by organic sources of N supplementation and weed control methods have been presented in (Table 1). A cursory glance over the data indicates that leaf area index was increasing at higher rate up to 60 DAS and thereafter, the rate of increase was slow up to 90 DAS. The various organic sources of N supplementation influenced the leaf area index significantly at all the stages. Significant increase in leaf area index was obtained with application of vermin-compost as compared to rest organic sources. Vermi- compost (M_1) being at par with poultry manure (M_2) recorded significantly higher leaf area over M_3 and M_4. Leaf area index decreased significantly with hand weeding treatment as compared to control at all growth stages. The maximum leaf area index. At 60 and 90DAS, two hand weeding at 25 and 50 days after sowing, recorded highest leaf area index, which was significantly higher than one hand weeding and weedy check. The trend of data was similar during both the years of study. Interaction effect was found non-significant between the organic sources of N supplementation and weed managements at all the stages of crop growth in respect of leaf area index [20].

Number of ear (m^{-2})

The scrutiny of data summarized in (Table 1) revealed that there was a significant increase in the number of ears (m^{-2}) with successive stages of crop growth. Vermi-compost method of N supplementation recorded significantly a greater number of ears (m^{-2}) over rest organic sources. Significant superiority was also noted by application of poultry manure over city manure and FYM treatment. However, city manure and FYM sources were at par with each other the fashion of data was similar during both the years. As far as the various weed management practices were concerned, hand weeding twice (25 & 50 DAS/T) recorded significantly higher number of ears (m^{-2}) as compared to one hand weeding at 25 days stage and weedy check. However, one hand weeding at 25 days stage recorded significantly higher number of ears over weedy check. Weedy check produced significantly a smaller number of ears as compared to all the weed management practices during both the years experimentation.

Table 1 Effect of weed control method and nitrogen supplementation through organic sources on initial plant population and height of plant at different crop duration

Organic source of nitrogen	Initial plant population		Plant height		No. of tiller		Leaf area index		Tillers		Test weight		Grain per ear	
	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019	2018	2019
M_1	174.67	175.60	86.03	87.93	315.19	321.16	4.51	4.57	286.53	291.97	40.88	41.07	51.83	52.26
M_2	176.63	177.97	83.80	85.70	290.22	293.99	4.40	4.47	263.83	267.27	40.82	41.00	51.13	51.61
M_3	163.43	164.47	76.20	77.80	269.57	273.46	3.71	3.77	245.07	248.60	40.73	40.92	47.28	47.71
M_4	173.13	174.10	72.80	74.47	278.89	282.77	3.92	3.98	253.53	257.07	40.72	40.88	47.88	48.32
SE(m)±	4.290	4.053	1.941	1.892	5.212	5.881	0.098	0.098	5.625	5.286	1.038	1.078	0.978	1.243
CD (p=0.05)	NS	NS	5.694	5.550	15.287	17.250	0.288	0.287	16.497	15.505	NS	NS	2.869	3.645

Number of grains ear^{-1}

The scrutiny of data summarized in (Table 1) revealed that there was a significant increase in the number of grains/ear due to application organic sources for N supplementation. Application of vermin-compost being at par with poultry manure and FYM recorded significantly a greater number of grains per panicle over city manure. Trend of data was similar during both the years of experimentation. As far as the various weed management practices were concerned, hand weeding twice (25 & 50 DAS) recorded significantly higher number of grains per panicle as compared to one hand weeding at 25 days stage alone and weedy check. However, one hand weeding at 25 days stage recorded significantly higher number of number of grains per panicle over weedy check. The weedy check produced lowest number of grains per panicle during both the years of experimentation.

Test weight (g)

It is evident that different organic sources of N supplementation did not affect the test weight to the level of significance (Table 1). However, the highest test weight of 41.88 g and 41.07 g was recorded under vermi-compost method of N supplementation during 2018 and 2019, respectively. Weed management practices also did not affect the test weight significantly during both the years. Highest test weight of 41.09 g and 41.31 g was recorded with W_2 (two hand weeding at 25 and 50 DAS) during both the years.

CONCLUSIONS

The height and other biophysical factors showed greater variations in response to organic minerals. The cultivar namely RAJ-4037 which is best for dry land area and crop matures in 120 days. This variety is suitable for bakery and beverage industry, has been taken. The pre availability of manures were measured and the application of various fertilizers have been done as per the recommended dose for the cultivation. The results revealed that organic minerals had a significant impact to influence the various biophysical traits such as height (65-87cm), number of tillers (273-315) while the maximum leaf area index was recorded maximum in vermin compost treatment.

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