International Journal of Advanced Research and Development
ISSN: 2455-4030; Impact Factor: RJIF 5.24
Received: 16-11-2018; Accepted: 19-12-2018
www.advancedjournal.com
Volume 4; Issue 1; January 2019; Page No. 55-57

Response of late sown Wheat (*Triticum aestivum* L.) to organics

Tammi Fazily[1], CS Hunshal[2]
[1] Department of Agronomy, Agriculture Faculty of Baghlan University, Pulikumri, Afghanistan
[2] Department of Agronomy, UASD, Karnataka, India

Abstract
A field experiment was conducted during *rabi* season of 2010-11 on medium black soil of Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the response of late sown wheat **(***Triticum aestivum* L.**)** to organics under irrigation. Application of RPP (RDF+FYM @ 7.5 t ha^{-1}) recorded significantly taller plants (68.11 cm), higher dry matter production (204.90 g/m row length) and number of effective tillers (137/ row length) at 90 DAS and greater ear length (9.01 cm), higher number of grains (41/ear), grain weight (1.39/ear) and (90.87 g/m row length), 1000 grain weight (34.37 g), grain yield (2724 kg/ha), straw yield (4690 kg/ha), protein content (13.27%), net returns (Rs 35104/ha) and B:C (2.62) compared to other treatments. Under organic treatments sheep manure (50%) basal +poultry manure (50%) as top dressing at 30 DAS clearly followed RPP.

Keywords: FYM, compost, vermicompost, poultry manure, sheep manure, wheat

1. Introduction
Wheat is a predominant winter (*rabi*) crop of northwestern plain zone and central zone of India. The use of inorganic fertilizers for the past 50 years without any addition of organic manures resulted in the large scale deficiency of micro nutrients which play an important role in enhancing the quality and quantity of the agriculture produce. Further, nutrient losses in inorganic fertilizer is very high and loss of nutrients like NO_3 some time lead to water pollution. Looking at all the above facts it is very much essential to find out the alternative to the chemical fertilizers which maintain the soil fertility and enhance the productivity of crops. Under such situation the use of organic manures in agriculture play an important role. The use of organics largely excludes the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives, enriches the soil, encourages bio-diversity, reduce the toxic bodies. Improves water quality, creates a safe environment for people and wild life, produces nutritious food of high quality, supply micronutrients in soil and maintains soil fertility and crop productivity. Hence, the present investigation was undertaken to know the response of late sown wheat *(Triticum aestivum* L.) to organics under irrigation [1, 2, 3].

2. Materials and Methods
The field experiment was carried out during winter season of 2010-11 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The crop was sown on December 2010 in medium black soil with pH of 7.3 and available nitrogen of 225 kg ha^{-1}, phosphorus of 37.25 kg/ha and potassium of 351 kg ha^{-1}. The experiment consisted of fourteen treatments viz., T_1: Farm yard manure (50%) basal+ vermicompost (50%) basal, T_2: Farm yard manure (50%) basal + poultry manure (50%) basal, T_3: Compost (50%) basal + vermicompost (50%) basal, T_4: Compost (50%) basal + poultry manure (50%) basal, T_5: Sheep manure (50%) basal + vermicompost (50%) basal, T_6: Sheep manure (50%) basal + poultry manure (50%) basal, T_7: Farm yard manure (50%) basal+ vermicompost (50%) top dressing at 30 DAS, T_8: Farm yard manure (50%) basal+ poultry manure (50%) top dressing at 30 DAS, T_9: Compost (50%) basal+ vermicompost (50%) top dressing at 30 DAS, T_{10}: Compost (50%) basal + poultry manure (50%) top dressing at 30 DAS, T_{11}: Sheep manure (50%) basal+ vermicompost (50%) top dressing at 30 DAS T_{12}: Sheep manure (50%) basal+ poultry manure (50%) top dressing at 30 DAS, T_{13}: RDF (100:75:50 NPK kg /ha) and T_{14}:RPP (RDF + farm yard manure @ 7.5 t/ha) in three replications. All organic manures were applied based on the content of nitrogen present in them by making nutrient equal to the recommended dose of fertilizer (N). Farm yard manure was used in all treatments @ 7.5 t/ha except $T_{13.}$ T_{13} and T_{14} received the entire dose of phosphorous and as basal dose through single super phosphate and muriate of potash. Nitrogen was applied as per the treatments in two equal splits viz., at basal and at 30 days after sowing (DAS) through urea. The crop was irrigated at 10 days interval. All other operations were performed as per recommendation for the crop. The row spacing was 22.5 cm ×10 cm. The data on various growth, yield, quality attributes and nutrient uptake by plant was recorded in different treatments.

3. Results & Discussion
3.1 Effect on growth
The treatment RPP produced significantly taller plants (68.11 cm), higher dry matter accumulation (204 g/m row length), LAI (2.69 at 30 DAS) and number of effective tillers (137/m row length) and it was found to be on par with $T_{12,}$ T_{10} and T_8 which had application of 50% N as top dressing through poultry manure although the basal dose was through either sheep manure or compost or FYM (Table-1). Ravindra Singh and Agarwal (2001) [10] reported that application of RDF+ FYM @ 20 t ha^{-1} in wheat resulted in higher growth parameters in wheat such as plant height (76.1 cm) and dry matter (151 g m^{-1} row length) compared to control (70.6 cm and 119.9 g m^{-1} row length, respectively). Significantly higher growth parameters with poultry manure (50%) combination is due to the fact that in poultry manure

mineralization is rapid and the rate of release of The significant increase in leaf area and leaf area index at 60 DAS with RPP, might be due to excess use of nitrogen as FYM, but in $T_{12,}$ T_{10} and T_8 which had application of 50% N as top dressing through poultry manure might be due to the rapid mineralization and nutrient availability of poultry manure (Gopalreddy, 1997; Willrich *et al*., 1974 and Sims, 1987) [15, 11]. Significantly higher number of effective tillers throughout the crop growth in RPP is reported by Patil and Bhilare (2000) [9]. Better availability of nutrients in both RDF and organic manure combinations might have better tillering of wheat. And the significant increase with The treatments receiving poultry manure (50%) top dressing at 30 DAS, along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately is in conformity with Singh *et al*. (2001) [12]. Application of 80 kg N ha^{-1} through poultry manure or substituting 75 per cent N through poultry manure and 25 per cent N through urea to wheat recorded the highest number of effective tillers per meter row (63) and highest seed yield (15.37 q ha^{-1}) as compared to control (49.37 and 10.00 q ha^{-1}, respectively) and a similar result was reported by Gopalreddy (1997).

Table 1: Effect of organic manures on growth parameters of wheat

Treatment	Plant height at harvest (cm)	Total dry matter production (g /m row length) at harvest	LAI at 60 DAS	Number of effective tillers/m row length at harvest
T_1-FYM (50%) basal +VC (50%) basal	61.24	169.14	2.05	117
T_2- FYM (50%) basal +PM (50%) basal	61.73	173.67	2.14	120
T_3- Compost (50%) basal +VC (50%) basal	61.33	171.20	2.06	118
T_4- Compost (50%) basal +PM (50%) basal	61.80	174.62	2.09	120
T_5- Sheep manure (50%) basal +VC (50%) basal	61.50	171.71	2.07	118
T_6- Sheep manure (50%) basal +PM (50%)basal	61.87	175.19	2.12	121
T_7- FYM (50%) basal +VC (50%) top dressing at 30 DAS	58.03	155.36	1.88	111
T_8- FYM (50%) basal +PM (50%) top dressing at 30 DAS	64.36	186.85	2.15	125
T_9- Compost (50%) basal +VC (50%) top dressing at 30 DAS	56.73	155.01	1.75	105
T_{10}- Compost (50%) basal +PM (50%) top dressing at 30 DAS	64.73	189.64	2.38	127
T_{11}- Sheep manure (50%) basal +VC (50%) top dressing at 30 DAS	57.17	155.01	1.80	111
T_{12}- Sheep manure (50%) basal +PM (50%) top dressing at 30 DAS	64.77	191.72	2.46	130
T_{13}-RDF	61.66	173.28	2.12	119
T_{14}-RPP (RDF+FYM)	68.11	204.90	2.69	137
S.Em+	1.42	4.09	0.087	2.44
C.D. at 5%	4.13	12	0.25	7

3.2 Effect on yield

The yield components namely, ear length (cm), number of grains per ear, grain weight per ear, grain weight per m^{-1} row length and 1000 grain weight were significantly higher with RPP, followed by the treatments receiving poultry manure (50%) top dressing at 30 DAS, along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately (Table-2). These results are in akin with Ghosh *et al*. (2001) [5] in rice, Patil and Bhilare (2000) [9] and Billore *et al*. (2009) [3] in wheat. Better nutrient availability in both RDF and organic manure combination might have resulted in better tillering (Patil and Bhilare, 2000) [9] and also better translocation of food reserves from source to sink leading to better filling of the seed, thus, resulting in higher 1000 seed weight. Billore *et al*. (2009) [3] revealed that integrating poultry manure @25 t ha^{-1} followed by farmyard manure @ 5 t ha^{-1} with recommended 50% RDF improved the yield of wheat following soybean.

The grain yield (90 g per m^{-1} length and 2724 kg ha^{-1}) and straw yield (4690 kg ha^{-1}) were significantly higher with RPP, followed by treatments receiving poultry manure (50%) top dressing at 30 DAS along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately (T-2). The significantly higher grain and straw yield with RPP might be due to the higher nitrogen availability throughout the crop growth, which caused the higher yield, and this result is in conformity with Sharma and Vyas (2001) who reported that application of 10 t ha^{-1} of FYM to wheat yielded 42.30 q ha^{-1}, whereas, the untreated plot recorded the yield of 37.37 q ha^{-1}. Similar result was reported by Negi *et al*. (1988) [8] in wheat. Abundant supply of nutrients through organics and inorganics might have the protoplasmatic constituents and accelerated the process of cell elongation. This inturn might have increased the values of growth and yield contributing attributes which is reflected in grain and straw yield of wheat (Auti *et al*., 1999) [2]. Further, significantly higher grain and straw yield obtained from treatments receiving poultry manure (50%) top dressing at 30 DAS, along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately, might be due the better nutrient availability and rapid release of nutrient from poultry manure. The reason also could be that the micronutrient content of poultry manure has increased the yield. Gopalreddy (1997) reported that poultry manure contains 2.00, 1.97 4.29 per cent nitrogen, phosphorus, potassium and 113.2, 71.0, 1400.6, 310.5 mg per kg of total Zn, Cu, Fe and Mn, respectively. Channabasanagowda *et al.* (2008) [4] reported that application of vermicompost@ 3.8 t ha^{-1} +poultry manure @ 2.45 t ha^{-1} recorded significantly higher seed yield of wheat (3043 kg ha^{-1}) compared to other treatments.

The grain protein estimation revealed that there was significantly higher grain protein content (13.27 %) due to combined application of RDF and recommended package of practice, followed by treatments receiving poultry manure (50%) top dressing at 30 DAS, along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately (Table-2). Increase in protein content of wheat through combined application of organic and inorganic, and combination of poultry manure (50%) top dressing at 30 DAS, along with basal combination of sheep manure (50%), compost (50%) and FYM (50%) separately, could be attributed to increased uptake of nitrogen due to the improvement in soil fertility and its consequent storage in

grains. Nitrogen being the essential constituent, makes up for 16 per cent by weight of protein, affects the protein content and enhances it, if it is available in abundance (Attar Singh, 1991). Khan *et al.* (2008) indicated that the application of 10, 15, 20, 25 and 30 t ha^{-1} FYM and 4, 6, 8, 10 and 12 t ha^{-1} poultry manure significantly increased the per centage grain protein content in maize (8.15%) which was with 12 t ha^{-1} poultry manure application. Channabasana gowda *et al.* (2008) [4] reported that application of vermicompost@ 3.8 t ha^{-1} +poultry manure @ 2.45 t ha^{-1} recorded significantly higher protein content in wheat (13.41%) compared to other treatments.

Table 2: Effect of organic manures on yield, yield parameters and grain quality of wheat

Treatment	Ear length (cm)	No. of grains/ear	Grain weight (g)/ear	Grain weight/m row length (g)	1000 grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Crude protein content (%)
T_1	7.53	36.23	1.04	74.70	30.83	2115	3522	12.25
T_2	7.77	36.96	1.10	77.27	31.23	2322	3889	12.28
T_3	7.56	36.40	1.33	75.04	30.85	2126	3586	12.20
T_4	7.87	36.50	1.10	77.53	31.34	2358	3853	12.31
T_5	7.57	36.43	1.09	75.69	31.03	2176	3572	12.26
T_6	7.88	36.97	1.16	77.76	31.43	2372	4010	12.33
T_7	7.21	33.10	1.00	69.76	29.86	2019	3323	11.78
T_8	8.27	38.25	1.21	80.07	32.53	2511	4320	12.75
T_9	7.16	32.40	0.95	68.56	29.45	1955	3194	11.72
T_{10}	8.32	38.48	1.26	82.84	32.85	2578	4434	12.77
T_{11}	7.10	32.89	0.99	69.86	29.67	2012	3287	11.72
T_{12}	8.36	38.78	1.28	84.20	33.47	2610	4491	12.83
T_{13}	7.60	36.46	1.10	76.91	31.09	2194	3725	12.27
T_{14}	9.01	41.04	1.39	90.78	34.37	2724	4690	13.27
S.Em±	0.12	1.18	0.04	1.93	0.42	35	66	0.15
C.D. at 5%	0.35	3.45	0.12	5.62	1.22	102	192	0.44

4. Conclusions

To achieve maximum yield of wheat during *rabi* season under irrigation, an integrated nutrient management system involving farm yard manure (7.5 t ha^{-1}) and RDF(100:75:50 N, P_2O_5, K_2O kg ha^{-1}) helps in maximizing the grain and straw yield as well as quality parameters of wheat.

Under organic production system, integrated organic nutrient management practices involving application of sheep manure (50%) + poultry manure (50%) top dressing at 30 DAS also resulted in higher net returns over other organic manure combinations as well as chemical fertilizers alone. For sustaining the soil fertility and crop productivity, application of sheep manure (50%) + poultry manure (50%) top dressing at 30 DAS is recommended.

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