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# Effect of wheat [*Treticum aestivum* (L.)] varieties under fertility levels and seed rates on growth and economics of crop plant

**Anil Kumar Rai, JP Dixit, Jan Mejay Sharma, Dharmendra Gaur and Dinesh Kumar Paliwal**

**Abstract**
A field field experiment was conducted during 2013-14 and 2014-15 at research farm, RVSKVV, College of Agriculture, Gwalior, Madhya Pradesh. The experiment involve thirty treatment combinations consisting of two varieties *viz.* $V_1$: RVW 4106 and $V_2$: MP 4010 as well as three seed rates *viz.* $S_1$: 100 kg/ha; $S_2$: 125 kg/ha and $S_3$: 150 kg/ha and five fertility levels i.e. $F_1$: 50% RDF + 10 tonnes FYM/, $F_2$: 75% RDF + 5 tonnes FYM/ha, $F_3$: 100% RDF, F4: 125% RDF and $F_5$: 150 % RDF in factorial R.B.D with 3 replications. The result revealed that plant population were non-significant in respect to varieties and fertility levels whereas seed rate of 150 kg/ha recorded significant with higher plant population as compare to others. Among the varieties, MP-4010 resulted the higher values of all these characters. Seed rate also had a significant effect on plant height at all the stages. Seed rate of 150 kg/ha recorded significantly effect on plant height at all the stages. Significantly higher number of leaves was recorded with 125 kg/ha seed rate followed by 150 kg/ha. In case of dry weight per plant, Lower seed rate (100 kg/ha) significantly produced maximum dry weight at 60 DAS and at maturity stage while at 60 DAS. Highest plant dry weight was obtained with 125 kg/ha seed rate whereas the application of 150% RDF recorded significantly higher plant height. The other growth characters *viz*. number of leaves, dry weight per plant were higher under the fertility level of $F_2$:75% RDF + 5 tonnes FYM /ha. Variety MP-4010 with seed rate 125kg/ha under 75% RDF + 5 tonnes FYM /ha gave the maximum net income of Rs. 64581 /ha as compared to the other treatment combinations. The minimum net monetary return obtained by $F_1S_1V_1$ (Rs 42433 /ha). Amongst the varieties, MP 4010 recorded the more net income (Rs. 56407/ha) with B:C ratio 3.03 as compared to RVW 4106. Amongst seed rate, crop sown with 150kg/ha seed rate gave highest gross and net income followed by seed rate 125 kg/ha whereas maximum B:C ratio was recorded with 125kg/ha. However, fertility levels of $F_2$:75% RDF + 5 tonnes FYM/ha recorded the highest net income (Rs. 59536/ha) and B:C ratio (3.16).

**Keywords:** economics, crop plant, *Treticum aestivum*, rates

## Introduction
Wheat (*Triticum aestivum* L.) is one of the most important cereal crops of India. There has been tremendous increase in area, production and productivity of this crop during the green revolution phase of Indian agriculture. It occupies second position both in terms of area and production in our country. It is cultivated in area of 29.50 million hectares with annual production of 93.62 million tonnes and productivity of 3140 kg/ha in 2011-12, whereas, in Madhya Pradesh, it is cultivated in 49.50 lakh ha. Land with an annual production of 134.15 lakh tonnes with productivity of 2710 kg/ha (Anonymous, 2012) [1].

Wheat is the main cereal crop in India. The total area under the crop is about 29.8 million hectares in the country. The production of wheat in the country has increased significantly from 75.81 million MT in 2006-07 to an all time record high of 94.88 million MT in 2011-12. The productivity of wheat which was 2602 kg/ha in 2004-05 has increased to 3140 kg/ha in 2011-12. The major increase in the productivity of wheat has been observed in the states of Haryana, Punjab and Uttar Pradesh. Higher area coverage is reported from MP in recent years (Anonymous, 2012) [1].

Better yield under late sown wheat are the results of improved crop stand, better utilization of resources like moisture and nutrients by early and vigorously growing seedlings and ultimately more numbers of tillers. Consequently, primed seeds also result in better performance under late sown conditions to suboptimal environmental conditions such as chilling, low soil moisture and high temperature during grain filling period. In cotton-wheat belt wheat sowing is delayed due to late maturing cotton varieties and final picking goes up to December and even January. Heavy insect pest infestation particularly mealy bug attacks also force the

problems to get the more pickings and delay their cotton harvesting, so that additional returns may be snatched which in turn results in late sowing of wheat.

The Indian farmers have been using old and inefficient methods and techniques of production generation after generation. Increase in production is possible only if proper and adequate manures are used. But, in India, the use of both farmyard manures and chemical fertilizer is mostly inadequate compared to our needs. The importance of good quality seeds to increase agricultural productivity hardly requires any emphasis. But, Indian farmers have been using seeds of very poor quality for decades. In addition, farmers are not applying well decomposed farmyard manure or compost to increase fertility of the soils and thus reduce expenditure by avoiding costly chemical fertilizers. Similarly, to reduce production cost, different allelopathic water extracts in combination with reduced herbicide doses can be used to control weeds. Considering the above fact therefore there is a need to judge the Effect of wheat [*Treticum aestivum* (L.)] varieties under fertility levels and seed rates on growth and economics of crop plant.

**Method and Materials**

The present experiment entitled "Effect of recent wheat [*Treticum aestivum* (L.)] varieties in various fertility levels and seed rates under late sown condition" was carried out during two consecutive Kharif seasons of 2013-14 and 2014-15 at research farm, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, College of Agriculture, Gwalior, Madhya Pradesh. The experimental soil was sandy clay loam in texture, with pH 7.58, EC 0.44 $dSm^{-1}$, Organic carbon 0.43% with available N (167.00 kg $ha^{-1}$), $P_2O_5$ (14.60 kg $ha^{-1}$) and $K_2O$ (239.30 kg $ha^{-1}$). The study involve thirty treatment combinations consisting of two varieties *viz*. $V_1$: RVW 4106 and $V_2$: MP 4010 as well as three seed rates *viz*. $S_1$: 100 kg/ha; $S_2$: 125 kg/ha and $S_3$: 150 kg/ha and five fertility levels i.e. $F_1$: 50% RDF + 10 tonnes FYM/, $F_2$: 75% RDF + 5 tonnes FYM/ha, $F_3$: 100% RDF, F4: 125% RDF and $F_5$: 150 % RDF in factorial R.B,D design with 3 replications.

The crop was grown as per recommended package of practices in both the years. The periodical observations were recorded on growth parameters studies and economical gain as per prescribed procedures as;

**Plant population/m row length**

One metre long row was selected randomly at different places in each plot. Later on the number of plants from selected row in each plot was counted and their average was taken for calculation.

**Height of plant**

The height of the plant was measured in centimeter by metre scale from ground level to the collar of the flag leaf. Height was measured at four stages, first at 30 days after sowing and other at 30 days interval.

**Number of leaves/ plant**

After 30, 60, 90 days of sowing and at maturity, number of green leaves were counted from 5 tagged plants. Fallen leaves were ignored.

**Economics of treatment**

For different treatments economics was calculated on the basis of prevailing market rates of field preparation, fertilizer, sowing of seeds, labour charges, cultural and intercultural operations etc.

**Gross return**

For different treatments gross returns were calculated on the basis of prevailing market rate of produce.

**Net profit**

The treatment wise cost of cultivation per hectare was subtracted from the gross income for computing net returns of each treatment.

Net profit (Rs./ha) = Gross return (Rs./ha) - Cost of cultivation (Rs./ha)

**Benefit: Cost Ratio (BCR)**

The gross income per hectare of each treatment was divided by the cost of cultivation of respective treatments to get the return per rupee invested.

$$\text{Benefit Cost Ratio (BCR)} = \frac{\text{Gross return}}{\text{Cost of cultivation}}$$

**Result and Discussion**

**Plant population / m row length**

The data in Table related to population indicate that the plant population per metre row length remained statistically unchanged (non-significant) under the various treatments without giving any definite trend except seed rates. It obviously reflected the fact from these data that the sowing of wheat was done properly, uniformly in each treatment using healthy and viable seeds to maintain the better germination, emergence and crop stand per unit area. Thus, the crop stand remained almost uniformly sufficient in all the fertility and varietal treatments. There was no harmful effect of the chemical fertilizers and herbicides on wheat. Amongst seed rate maximum population was found under 150 kg/ha seed rate and minimum was recorded with 100 kg/ha seed rate. Highest population under used of 150 kg/ha was found due to more seed rate.

**Growth characters**

The plant is the product of its genetic constitution and environment. The genetic pattern is a fixed quantity for a given plant and determines its potential for maximum growth under favourable environment for its development. The analysis of growth and development is a prerequisite to understand the growth behavior of crop in the field.

The growth and development of the plants depends on the initiation of tissues and organ primordial and on the differentiation and expansion of cells. Several metabolic activities/ reactions are associated with this phenomenon which involves the uptake of nutrients from soil, the synthesis of metabolites and the transport of substances within the plant body. Adequate moisture, nutrients, space and light play an important role.

All the growth parameters viz., plant height, number of leaves per plant, dry weight per plant were significantly influenced by varieties at all the growth stages and at harvest except at 30 DAS in respect to all these above growth characters and at harvest stage in case of number of leaves per plant. Between the varieties, MP 4010 resulted into the significant higher values of all these characters. The differences in growth characters due to varieties may be attributed to their inherent characteristics and adaptability to soil and climatic conditions. The results are in close

**Table 1:** Effect of different varieties, seed rates and fertility levels on plant population per meter row length of wheat at initial and harvest stages of crop.

| Treatments | | Plant population/m row length at | | | | | |
|---|---|---|---|---|---|---|---|
| | | Initial (15 DAS) | | | Harvest | | |
| **A.** Varieties | Sy. | 2012-13 | 2013-14 | Pooled | 2012-13 | 2013-14 | Pooled |
| RVW 4106 | $V_1$ | 21.7 | 21.5 | 21.6 | 21.4 | 21.4 | 21.40 |
| MP 4010 | $V_2$ | 22.1 | 22.2 | 22.1 | 21.9 | 22.0 | 21.93 |
| S.E. m (d) ± | | 0.28 | 0.34 | 0.22 | 0.24 | 0.31 | 0.20 |
| C.D. (at 5%) | | NS | NS | NS | NS | NS | NS |
| **B. Seed rates** | | | | | | | |
| 100 kg/ha | $S_1$ | 19.9 | 20.2 | 20.1 | 19.9 | 20.2 | 20.1 |
| 125 kg/ha | $S_2$ | 21.6 | 21.6 | 21.6 | 21.6 | 21.6 | 21.6 |
| 150 kg/ha | $S_3$ | 24.2 | 23.7 | 24.0 | 23.5 | 23.2 | 23.4 |
| S.E. m (d) ± | | 0.34 | 0.42 | 0.27 | 0.29 | 0.38 | 0.24 |
| C.D. (at 5%) | | 0.94 | 1.15 | 0.74 | 0.81 | 1.06 | 0.67 |
| **C. Fertility levels** | | | | | | | |
| 50% RDF + 10 tonnes FYM /ha | $F_1$ | 22.1 | 21.6 | 21.8 | 21.7 | 21.3 | 21.5 |
| 75% RDF + 5 tonnes FYM /ha | $F_2$ | 22.3 | 22.0 | 22.1 | 21.9 | 22.0 | 21.9 |
| 100% RDF | $F_3$ | 21.7 | 21.8 | 21.8 | 21.6 | 21.5 | 21.6 |
| 125% RDF | $F_4$ | 22.1 | 21.9 | 22.0 | 22.0 | 21.7 | 21.9 |
| 150% RDF | $F_5$ | 21.3 | 22.0 | 21.6 | 21.0 | 21.8 | 21.4 |
| S.E. m (d) ± | | 0.44 | 0.54 | 00.35 | 0.38 | 0.49 | 0.31 |
| C.D. (at 5%) | | NS | NS | NS | NS | NS | NS |
| Interaction | | NS | NS | NS | NS | NS | NS |

**Table 2:** Cost of cultivation of wheat as influenced by varieties, seed rates and fertility levels

| Treatments | Sy. | Cost of cultivation (Rs./ha) | | |
|---|---|---|---|---|
| **A. Varieties** | | **2013-14** | **2014-15** | **Pooled** |
| RVW 4106 | $V_1$ | 27058 | 28458 | 27758 |
| MP 4010 | $V_2$ | 27058 | 28458 | 27758 |
| **B. Seed rates** | | | | |
| 100 kg/ha | $S_1$ | 26308 | 27658 | 26983 |
| 125 kg/ha | $S_2$ | 27058 | 28458 | 27758 |
| 150 kg/ha | $S_3$ | 27808 | 29258 | 28533 |
| **C. Fertility levels** | | | | |
| 50% RDF + 10 t FYM /ha | $F_1$ | 28116 | 29516 | 28816 |
| 75% RDF + 5 t FYM /ha | $F_2$ | 26837 | 28237 | 27537 |
| 100% RDF | $F_3$ | 25558 | 26958 | 26258 |
| 125% RDF | $F_4$ | 26779 | 28179 | 27479 |
| 150% RDF | $F_5$ | 27999 | 29399 | 28699 |

**Table 3:** Cost of cultivation of wheat as influenced by varieties, seed rates and fertility levels

| Treatments | Cost of cultivation (Rs./ha) | | | | | |
|---|---|---|---|---|---|---|
| | 2013-14 | | 2014-15 | | Pooled | |
| | V1 | V2 | V1 | V2 | V1 | V2 |
| F1S1 | 27366 | 27366 | 28716 | 28716 | 28041 | 28041 |
| F1S2 | 28116 | 28116 | 29516 | 29516 | 28816 | 28816 |
| F1S2 | 28866 | 28866 | 30316 | 30316 | 29591 | 29591 |
| F2S1 | 26087 | 26087 | 27437 | 27437 | 26762 | 26762 |
| F2S2 | 26837 | 26837 | 28237 | 28237 | 27537 | 27537 |
| F2S3 | 27587 | 27587 | 29037 | 29037 | 28312 | 28312 |
| F3S1 | 24808 | 24808 | 26158 | 26158 | 25483 | 25483 |
| F3S2 | 25558 | 25558 | 26958 | 26958 | 26258 | 26258 |
| F3S3 | 26308 | 26308 | 27758 | 27758 | 27033 | 27033 |
| F4S1 | 26029 | 26029 | 27379 | 27379 | 26704 | 26704 |
| F4S2 | 26779 | 26779 | 28179 | 28179 | 27479 | 27479 |
| F4S3 | 27529 | 27529 | 28979 | 28979 | 28254 | 28254 |
| F5S1 | 27249 | 27249 | 28599 | 28599 | 27924 | 27924 |
| F5S2 | 27999 | 27999 | 29399 | 29399 | 28699 | 28699 |
| F5S3 | 28749 | 28749 | 30199 | 30199 | 29474 | 29474 |

Conformity with the findings of Jadhao and Nalamwar (1993) [2], and Prabhakar *et al*. (2002) [8, 9] who reported that the wheat genotypes had significant differed vegetative growth in terms of plant height and dry matter.

Seed rate had a significant effect on plant height at all the stages. It can be inferred that among the seed rate, taller plants were noted in those plots, which were sown with 150 kg/ha while shorter plants was recorded for 100 kg/ha. These results also corroborate with the finding of Khan *et al*. (2002) [3].

Number of leaves per plant and dry weight per plant also significantly varied by seed rate almost at all the stages except at 30 DAS. Significantly higher number of leaves was recorded with 125 kg/ha seed rate followed by 150 kg/ha. Lowest number of leaves per plant was registered under crop sown with 100 kg/ha seed rate. In case of dry weight per plant, Lower seed rate (100 kg/ha) significantly produced maximum dry weight at 60 DAS and at maturity stage while at 60 DAS Highest plant dry weight was obtained with 125 kg/ha seed rate. Highest seed rate (150 kg/ha) gave lowest dry weight per plant. The reduction in the dry weight in wheat due to higher seed rate was also observed by the Laghari *et al*. (2011) [5].

The different fertility levels brought about significant influence upon plant height, number of leaves per plant and dry weight per plant. This was observed almost at every stage of observation.

The significantly more plant height was recorded under the application of 150% RDF, followed by 75% RDF + 5 tonnes

FYM /ha and 125% RDF over 50% RDF + 10 tonnes FYM /ha and 100% RDF.

**Table 4:** Plant height of wheat as influenced by varieties, seed rates and fertility levels at successive crop growth stages

| Treatments | | Plant height (cm) at | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAS | | | 60 DAS | | | 90 DAS | | | Harvest | | |
| **A. Varieties** | **Sy.** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** |
| RVW 4106 | $V_1$ | 12.61 | 12.85 | 12.73 | 51.01 | 52.01 | 51.51 | 84.93 | 85.83 | 85.38 | 85.23 | 86.11 | 85.67 |
| MP 4010 | $V_2$ | 12.83 | 13.11 | 12.97 | 51.81 | 52.97 | 52.39 | 87.36 | 87.80 | 87.58 | 87.69 | 88.11 | 87.90 |
| S.E. m (d) ± | | 0.10 | 0.11 | 0.07 | 0.25 | 0.29 | 0.19 | 0.25 | 0.31 | 0.20 | 0.26 | 0.30 | 0.20 |
| C.D. (at 5%) | | NS | NS | 0.20 | 0.69 | 0.82 | 0.53 | 0.70 | 0.85 | 0.55 | 0.73 | 0.84 | 0.56 |
| **B. Seed rates** | | | | | | | | | | | | | |
| 100 kg/ha | $S_1$ | 11.87 | 12.10 | 11.98 | 48.89 | 49.94 | 49.41 | 83.62 | 84.30 | 83.96 | 83.92 | 84.62 | 84.27 |
| 125 kg/ha | $S_2$ | 12.90 | 13.18 | 13.04 | 51.68 | 52.79 | 52.23 | 86.40 | 87.12 | 86.76 | 86.69 | 87.39 | 87.04 |
| 150 kg/ha | $S_3$ | 13.39 | 13.65 | 13.52 | 53.67 | 54.75 | 54.21 | 88.41 | 89.01 | 88.71 | 88.77 | 89.31 | 89.04 |
| S.E. m (d) ± | | 0.15 | 0.17 | 0.12 | 0.30 | 0.36 | 0.24 | 0.31 | 0.38 | 0.24 | 0.32 | 0.37 | 0.25 |
| C.D. (at 5%) | | 0.43 | 0.48 | 0.32 | 0.84 | 1.00 | 0.65 | 0.85 | 1.04 | 0.67 | 0.89 | 1.03 | 0.68 |
| **C. Fertility levels** | | | | | | | | | | | | | |
| 50% RDF + 10 tonnes FYM /ha | $F_1$ | 11.50 | 11.81 | 11.66 | 47.93 | 49.58 | 48.76 | 82.74 | 83.12 | 82.93 | 83.02 | 83.42 | 83.22 |
| 75% RDF + 5 tonnes FYM /ha | $F_2$ | 13.21 | 13.37 | 13.29 | 52.68 | 53.73 | 53.21 | 87.68 | 88.12 | 87.90 | 87.98 | 88.42 | 88.20 |
| 100% RDF | $F_3$ | 12.31 | 12.81 | 12.56 | 50.39 | 51.47 | 50.93 | 84.70 | 85.85 | 85.28 | 85.00 | 86.16 | 85.58 |
| 125% RDF | $F_4$ | 13.11 | 13.45 | 13.28 | 52.75 | 53.83 | 53.29 | 87.31 | 88.33 | 87.82 | 87.61 | 88.63 | 88.12 |
| 150% RDF | $F_5$ | 13.46 | 13.46 | 13.46 | 53.30 | 53.84 | 53.57 | 88.30 | 88.64 | 88.47 | 88.71 | 88.92 | 88.81 |
| S.E. m (d) ± | | 0.12 | 0.13 | 0.09 | 0.39 | 0.46 | 0.30 | 0.40 | 0.48 | 0.31 | 0.41 | 0.38 | 0.32 |
| C.D. (at 5%) | | 0.33 | 0.37 | 0.25 | 1.09 | 1.29 | 0.84 | 1.10 | 1.34 | 0.87 | 1.15 | 1.33 | 0.88 |
| Interaction | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 5:** Number of leaves per plant of wheat as influenced by varieties, seed rates and fertility levels at successive crop growth stages

| Treatments | | Number of leaves/plant at | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAS | | | 60 DAS | | | 90 DAS | | | Harvest | | |
| **A. Varieties** | **Sy.** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** |
| RVW 4106 | **$V_1$** | 5.66 | 5.92 | 5.79 | 18.88 | 18.71 | 18.80 | 18.76 | 18.60 | 18.68 | 9.43 | 9.33 | 9.38 |
| MP 4010 | **$V_2$** | 5.91 | 5.97 | 5.94 | 19.55 | 19.41 | 19.48 | 19.39 | 19.33 | 19.36 | 9.71 | 9.85 | 9.78 |
| S.E. m (d) ± | | 0.09 | 0.10 | 0.07 | 0.20 | 0.22 | 0.15 | 0.22 | 0.23 | 0.16 | 0.19 | 0.22 | 0.15 |
| C.D. (at 5%) | | NS | NS | NS | 0.56 | 0.61 | 0.41 | 0.60 | 0.62 | 0.43 | NS | NS | NS |
| **B. Seed rates** | | | | | | | | | | | | | |
| 100 kg/ha | $S_1$ | 5.75 | 5.75 | 5.75 | 19.30 | 19.22 | 19.26 | 19.27 | 19.13 | 19.20 | 9.75 | 9.71 | 9.73 |
| 125 kg/ha | $S_2$ | 5.88 | 6.04 | 5.96 | 19.63 | 19.55 | 19.59 | 19.50 | 19.50 | 19.50 | 9.90 | 10.04 | 9.97 |
| 150 kg/ha | $S_3$ | 5.73 | 6.03 | 5.88 | 18.72 | 18.42 | 18.57 | 18.45 | 18.25 | 18.35 | 9.06 | 9.02 | 9.04 |
| S.E. m (d) ± | | 0.11 | 0.13 | 0.09 | 0.25 | 0.27 | 0.18 | 0.27 | 0.28 | 0.19 | 0.24 | 0.27 | 0.18 |
| C.D. (at 5%) | | NS | NS | NS | 0.68 | 0.75 | 0.51 | 0.74 | 76 | 0.53 | 0.65 | 0.76 | 0.50 |
| **C. Fertility levels** | | | | | | | | | | | | | |
| 50% RDF + 10 tonnes FYM /ha | $F_1$ | 5.52 | 5.39 | 5.46 | 15.74 | 15.50 | 15.62 | 15.64 | 15.44 | 15.54 | 6.29 | 6.06 | 6.18 |
| 75% RDF + 5 tonnes FYM /ha | $F_2$ | 6.18 | 6.31 | 6.24 | 21.77 | 21.50 | 21.63 | 21.63 | 21.44 | 21.54 | 11.80 | 11.97 | 11.89 |
| 100% RDF | $F_3$ | 5.54 | 5.64 | 5.59 | 16.30 | 15.92 | 16.11 | 16.28 | 15.90 | 16.09 | 6.97 | 6.60 | 6.78 |
| 125% RDF | $F_4$ | 5.77 | 6.07 | 5.92 | 21.29 | 21.31 | 21.30 | 21.14 | 21.12 | 21.13 | 11.40 | 11.74 | 11.57 |
| 150% RDF | $F_5$ | 5.92 | 6.30 | 6.11 | 21.00 | 21.08 | 21.04 | 20.67 | 20.89 | 20.78 | 11.39 | 11.58 | 11.49 |
| S.E. m (d) ± | | 0.15 | 0.17 | 0.11 | 0.32 | 0.35 | 0.24 | 0.34 | 0.36 | 0.25 | 0.30 | 0.35 | 0.23 |
| C.D. (at 5%) | | 0.41 | 0.46 | 0.31 | 0.88 | 0.97 | 0.65 | 0.95 | 0.99 | 0.78 | 0.84 | 0.98 | 0.65 |
| Interaction | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 6:** Dry weight of wheat (g/plant) as influenced by varieties, seed rates and fertility levels at successive crop growth stages

| Treatments | | Dry weight (g/plant) at | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 30 DAS | | | 60 DAS | | | 90 DAS | | | Harvest | | |
| **A. Varieties** | **Sy.** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** |
| RVW 4106 | $V_1$ | 1.23 | 1.23 | 1.23 | 4.46 | 4.47 | 4.47 | 8.40 | 8.41 | 8.40 | 9.37 | 9.29 | 9.33 |
| MP 4010 | $V_2$ | 1.24 | 1.23 | 1.23 | 4.59 | 4.56 | 4.58 | 8.61 | 8.62 | 8.62 | 9.65 | 9.60 | 9.62 |
| S.E. m (d) ± | | 0.01 | 0.01 | 0.004 | 0.04 | 0.03 | 0.02 | 0.06 | 0.07 | 0.05 | 0.07 | 0.09 | 0.06 |
| C.D. (at 5%) | | NS | NS | NS | 0.10 | 0.08 | 0.07 | 0.17 | 0.19 | 0.13 | 0.20 | 0.24 | 0.15 |
| **B. Seed rates** | | | | | | | | | | | | | |
| 100 kg/ha | $S_1$ | 1.24 | 1.23 | 1.24 | 4.56 | 4.59 | 4.58 | 8.88 | 8.89 | 8.89 | 9.92 | 9.87 | 9.90 |
| 125 kg/ha | $S_2$ | 1.23 | 1.24 | 1.23 | 4.64 | 4.62 | 4.63 | 8.56 | 8.54 | 8.55 | 9.58 | 9.51 | 9.54 |
| 150 kg/ha | $S_3$ | 1.22 | 1.22 | 1.22 | 4.37 | 4.33 | 4.35 | 8.08 | 8.11 | 8.10 | 9.02 | 8.95 | 8.98 |
| S.E. m (d) ± | | 0.01 | 0.01 | 0.005 | 0.04 | 0.05 | 0.04 | 0.08 | 0.09 | 0.06 | 0.09 | 0.10 | 0.07 |
| C.D. (at 5%) | | NS | NS | NS | 0.13 | 0.10 | 0.08 | 0.21 | 0.24 | 0.16 | 0.24 | 0.29 | 0.19 |
| **C. Fertility levels** | | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50% RDF + 10 tonnes FYM /ha | $F_1$ | 1.19 | 1.20 | 1.20 | 4.07 | 4.14 | 4.10 | 7.51 | 7.54 | 7.53 | 8.44 | 8.38 | 8.41 |
| 75% RDF + 5 tonnes FYM /ha | $F_2$ | 1.25 | 1.27 | 1.26 | 4.90 | 4.92 | 4.91 | 9.56 | 9.59 | 9.58 | 10.65 | 10.63 | 10.64 |
| 100% RDF | $F_3$ | 1.22 | 1.20 | 1.21 | 4.29 | 4.26 | 4.27 | 8.04 | 7.98 | 8.01 | 8.98 | 8.87 | 8.92 |
| 125% RDF | $F_4$ | 1.24 | 1.24 | 1.24 | 4.80 | 4.74 | 4.77 | 9.00 | 9.03 | 9.02 | 10.04 | 9.97 | 10.00 |
| 150% RDF | $F_5$ | 1.25 | 1.24 | 1.25 | 4.57 | 4.53 | 4.55 | 8.41 | 8.43 | 8.42 | 9.43 | 9.36 | 9.40 |
| S.E. m (d) ± | | 0.01 | 0.01 | 0.01 | 0.06 | 0.06 | 0.05 | 0.10 | 0.11 | 0.07 | 0.11 | 0.13 | 0.09 |
| C.D. (at 5%) | | 0.2 | 0.3 | 0.01 | 0.16 | 0.13 | 0.10 | 0.27 | 0.31 | 0.20 | 0.32 | 0.37 | 0.24 |
| Interaction | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 7:** Gross, income and B:C ratio of wheat as influenced by varieties, seed rates and fertility levels

| Treatments | Sy. | Gross income (Rs./ha) | | | Net income (Rs./ha) | | | B:C ratio | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **A. Varieties** | | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** | **2013-14** | **2014-15** | **Pooled** |
| RVW 4106 | $V_1$ | 80591 | 85861 | 83226 | 53533 | 57403 | 55468 | 2.98 | 3.02 | 3.00 |
| MP 4010 | $V_2$ | 81470 | 86860 | 84165 | 54412 | 58402 | 56407 | 3.01 | 3.05 | 3.03 |
| **B. Seed rates** | | | | | | | | | | |
| 100 kg/ha | $S_1$ | 76225 | 81282 | 78753 | 49917 | 53624 | 51770 | 2.90 | 2.94 | 2.92 |
| 125 kg/ha | $S_2$ | 82676 | 88197 | 85436 | 55618 | 59739 | 57678 | 3.06 | 3.10 | 3.08 |
| 150 kg/ha | $S_3$ | 84167 | 89604 | 86886 | 56359 | 60346 | 58353 | 3.03 | 3.06 | 3.05 |
| **C. Fertility levels** | | | | | | | | | | |
| 50% RDF + 10 tonnes FYM /ha | $F_1$ | 74711 | 79736 | 77223 | 46595 | 50219 | 48407 | 2.66 | 2.70 | 2.68 |
| 75% RDF + 5 tonnes FYM /ha | $F_2$ | 84349 | 89798 | 87073 | 57512 | 61560 | 59536 | 3.14 | 3.18 | 3.16 |
| 100% RDF | $F_3$ | 79885 | 85141 | 82513 | 54327 | 58183 | 56255 | 3.12 | 3.16 | 3.14 |
| 125% RDF | $F_4$ | 83056 | 88340 | 85698 | 56277 | 60161 | 58219 | 3.10 | 3.13 | 3.12 |
| 150% RDF | $F_5$ | 83145 | 88790 | 85967 | 55146 | 59390 | 57268 | 2.97 | 3.02 | 3.00 |

The other growth characters *viz*. number of leaves, dry weight per plant were higher under the fertility level of 75% RDF + 5 tonnes FYM /ha. The next effective fertility levels *viz.*, 125% RDF and 150% RDF were found superior over reaming fertility in respect of number of leaves and dry matter per plant. These results also corroborate with the finding of Laghari *et al.* (2010) [6] and Sharma *et al.* (2016) [12]. This may be owing to increased supply of multi-nutrients, plant growth regulators and beneficial microflora released from FYM in addition to the most favourable conditions with respect to physico-chemical and biological properties of the soil.

The boosted vegetative growth (height and dry matter per plant) due to increased multi-nutrients promoted plant growth by ensuring higher number of green leaves with increased photosynthesis as a result of increased metabolism of the absorbed plant nutrients, forming longer and stronger roots to absorb sufficient water and nutrients, These favoruable soil conditions brought about efficient utilization of plant nutrients accompanied by activating plant enzymes. The remarkable increase in root-shoot growth parameters due to 75% NPK + 5 tonnes FYM/ha /ha supplying additional nutrients may be as a result of acceleration of cell elongation and cell division. Similar findings have been reported by several research workers (Patel *et al*. 2012 and Kumar *et al.*, 2014**)** [7, 4].

## Economics

The maximum net income per hectare after deduction of cost of cultivation is the ultimate goal of any farm owner or grain producer. The overall picture, based on two years mean values, reflects the fact that variety MP 4010 with seed rate 125kg/ha under 75% RDF + FYM 2.5 t/ha gave the maximum net income of Rs. 64581 /ha as compared to the other treatment combinations which was followed by $F_2S_2V_1$ (Rs. 61486 /ha) The minimum net monetary return was obtained by $F_1S_1V_1$ (Rs 42433 /ha).

Amongst the wheat varieties, MP 4010 brought about the more net income (Rs. 56407/ha) with B:C ratio 3.03 as compared to RVW 4106. The net economical gain was secured in accordance with the per hectare yield of the varieties and thereby gross income. Similar results reported by Prabhakar *et al* (2002) [8, 9]

Amongst seed rate, crop sown with 150kg/ha seed rate gave highest gross and net income followed by seed rate 125 kg/ha. However, maximum B:C ratio was recorded with 125kg/ha seed rate. Thakur *et al*. (1996) [13] and Reddy and Patil (2003) [11] found highs net income with higher seed rate.

Moreover, 75% RDF + 5 tonnes FYM/ha would be advantageous in the long run because of the multifarious role of FYM for sustainable crop production and strengthening the soil fertility and health under eco-friendly environment. Fertility levels 75% RDF + 5 tonnes FYM/ha augmented highest net income ( Rs. 59536/ha) and B:C ratio (3.16). It may be due to FYM cheaper and effective source of ensuring nutrient availability by their biotic activities. Rather and Sharma (2009) [10] also reported also that the highest net return and benefit: cost of crop was recorded with combined application with fertilizer + FYM.

## Conclusion

On the basis of results obtained from this study, it can be concluded that the cultivation of wheat variety MP 4010 in late sown condition, when sown with the seed rate of 150 kg/ha and provided 75% of RDF along with 5 tonnes FYM /ha was found most profitable as compared to other treatments.

## References


1. Anonymous. Agriculture statistic at aglance, 2012.
2. Jadhao SL, Nalamwar RV. Response of wheat *(Triticum aestivum)* varietys to planting method and manual weeding. Indian J. Agron. 1993; 38(3):382-385.
3. Khan IA, Bakht J, Shah Wajid AKN, Ullah I. Effect of Seed Rate on the Yield and Yield Components of Wheat under Irrigated Conditions of Peshawar. Asian Journal of Plant Sciences. 2002; 1:513-515.
4. Kumar, Pradeep Singh, Paliwal RS, Dinesh, Kumar Sushil. Integrated nutrient management in pearl millet (*Pennisetum glaucum*) - wheat (*Triticum aestivum*) cropping sequence in semi arid condition of India.

International Journal of Agricultural Sciences. 2014; 10(1):96-101.
5. Laghari GM, Oad FC, Tunio S, Chachar Q, Gandahi AW, Siddiqui MH *et al*. Growth and yield attributes of wheat at different seed rates. Sarhad Journal of Agriculture. 2011; 27:177-183.
6. Laghari GM, Oad FC, Tunio SD, Gandhi AW, Siddiqui MH, Jagirani AW *et al*. Growth and nutrient uptake of various wheat cultivars under different fertilizer regimes. Sarhad Journal of agriculture. 2010; 26(4):489-497.
7. Patel SM, Patel JC, Chaudhary PP, Patel DM, Patel GN, Patel BM. Effects of nitrogen levels and weed management on production potential of wheat (*Triticum aestivum L*.). Research on Crops. 2012; 13(2):456-462.
8. Prabhakar BN, Halepyati AS, Pujari BT, Desai BK. Pattern of dry matter accumulation in wheat genotypes as influenced by sowing dates. Karnataka J Agril. Sci. 2002; 16(1):26-30.
9. Prabhakar BN, Halepyati AS, Pujari BT, Desai BK. Pattern of dry matter accumulation in wheat genotypes as influenced by sowing dates. Karnataka J Agril. Sci. 2002; 16(1):26-30.
10. Rather SA, Sharma NL. Effect of integrated nutrient management practices on yield and nutrient uptake by wheat and their residual effect on succeeding mung crop in wheat-mung cropping system. International Journal of Agricultural Sciences. 2009; 5(2):494-496.
11. Reddy SG, Patil BN. Response of wheat genotypes to different levels of nitrogen and seed rates under late sown condition. Karnataka Journal of Agricultural Science. 2003; 16(1):124-127
12. Sharma J, Tomar SS, Rajput RL, Prajapati BL, Yadav S. Effect of fertility levels and weed management practices on physiological growth parameters of irrigated wheat. Green farming. 2016; 7(3):633-637.
13. Thakur SS, Pandey IB, Singh SJ, Mishra SS. Effect of seed rate and row specing on late sown wheat in alluvial calcareous soil. Journal of Research. Birsa Agricultural University. 1996; 8(2):123-125.