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Physiological assessment of growth regulators on growth, yield and quality traits of basmati rice (*Oryza sativa* L.)

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Abstract

In the present study, a field experiment with eleven treatments and three replications of each treatments was conducted with Randomised Block Design (RBD) in Student Instructional Farm, C. S. Azad Uni. of Agriculture and Technology, Kanpur, (U.P), India, to explore new approach for yield and quality enhancement. Basmati rice plants were sprayed with growth regulators at tillering and before anthesis stage. Which were not only appreciate the yield but also increase the quality components. The treatments were; IAA 25 AND 50 ppm, Kinetin, 5 and 10 ppm, CCC 2000 and 4000 ppm, SADH 1000 and 3000 ppm and Ascorbic Acid 50 and 100 ppm. Results showed a conspicuous increase in yield components in treated plant. IAA and Kinetin, possessed a significant more number of tillers, leaves, biomass, grain starch content (%), grain protein content (%), pre-anthesis leaf nitrogen content. IAA caused increase in grain starch content, pre-anthesis nitrogen content of leaves while Kinetin 5 and 10 appreciated grain protein content. The yield attributing traits like number of panicle/plant, number of grains/panicle, grain weight, biomass, Harvest Index (HI) and finally grain yield was improved by the treatment of IAA 50 ppm.

Keywords: Foliar application, IAA, Kinetin, CCC, SADH, Ascorbic Acid, Basmati rice.

Introduction

Basmati rice is known as king of rice, also the oldest, common progenitor for most types and priced for its characteristic long-grain, subtle aroma and delicious taste. It is one of the major agricultural commodities, the country exports every year to earn foreign exchange. Basmati rice the world's most sought-after rice, fetching up to 10 times more than common rice in international markets. Basmati rice has several important characters like, is cholesterol-free, has only a trace of fat, and is sodium-free.

Low yield is a major cause to prohibit the public demand. So, it is very important to ensure the constant availability of basmati rice. Therefore, yield boosting agronomic technique such as application of certain Growth Regulators needs due attention.

In the present study, therefore, an attempt was made to find out how for certain growth regulating substances with their various concentrations influence physiology of growth, metabolism and yield of Basmati Rice. Thus, the use of growth regulators, such as IAA, Kinetin, CCC (Chlormequat chloride), SADH and Ascorbic acid with their different concentrations, is becoming popular to ensure efficient production.

Materials and Methods

The present research work was carried out in field. The treatments were: T₁- Control, T₂- IAA (25 ppm), T₃- IAA (50 ppm), T₄- Kinetin (5 ppm), T₅- Kinetin (10 ppm), T₆- CCC (2000 ppm), T₇- CCC (4000 ppm), T₈- SADH (1000 ppm), T₉- SADH (3000 ppm), T₁₀- Ascorbic Acid (50 ppm), T₁₁- Ascorbic Acid (100 ppm). Each treatment replicated three times.

Starch content in the grains was estimated by using the method of Mc Cready *et al.*, (1950). Nitrogen content in the plant material (leaf and grain) was estimated by using instrument, Semi-automatic Nitrogen Analyzer (Model KEL PLUS + KEL FREEZ). This instrument work on the principle of micro kjeldhal method of nitrogen analysis (Kjeldhal, 1883).

Result and Discussion

Improving effect on grain weight per plant was mainly examined significantly superior in case of IAA 50. This is a major yield supporting hormone. The lower doses of this hormone also gave a positive support against control followed by SADH 1000 ppm.

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Enhancement in grain weight per plant (Fig. 1) by IAA was due to expansion of leaves, which results in more photosynthesis, assimilation and ultimately more total dry matter. The finding is in agreement with Pandey *et al.*, (2001) [6] in rice and Hadole *et al.*, (2002) [4] in wheat, Meera Shrivastava (2003) [5] in Mustard [5].

The value of harvest index (HI) which is the ratio of economic yield and biological yield, improved by IAA 50 ppm followed by other treatments. Other treatments *viz.*, Kinetin and SADH, CCC and Ascorbic Acid also have constructive power in comparison to control plant. The central cause to amplified HI (Fig. 2) was owed to construction of more assimilates which participate in the establishment of economic yield in comparison to biological yield. Clarification pre-arranged by Pandey *et al.*, (2001) [6] in rice, Samantasiuhar and Sahu (1990) [8] in rice, Bakry (2013) [3] in wheat also supported the above result.

An overview on Grain Starch Content (%) defined that the rate of starch content is progressively increased by the treatment of IAA 50 ppm followed by Kinetin 10 ppm (Fig.3). CCC and Ascorbic Acid also have incrementing effect on this attribute. Although, SADH accelerate the starch content value non-significantly. The major cause of establishing high starch content is production of higher assimilates. This research work was approved by the research work of Aldesuquy H. S., (2001) [1] in wheat, Singh and Singh (1982) [9] in rice, Samantasiuhar and Sahu (1990) [8] in rice, Bakry (2013) [3] in wheat, Amin *et al.*, (2008) [2] in wheat.

Leaf is an importance source of food material of plant. The synthesized material was transported from leaf (source) to sink region. Nitrogen content of leaf at pre-anthesis stage is mainly uplifted by the foliar sprayed IAA 50 ppm followed by Ascorbic Acid 100 ppm (Fig.4). Kinetin and CCC, both had traits to accelerate the nitrogen value of leaf. Ascorbic Acid or Vitamin C also possesses this power but non-significant increment was noticed. This finding is also confirmed by the verdict of Tagade *et al.*, (1998) [11] in wheat, Meera Shrivastava (2003) [5] in Mustard, Tallat (2003) [5].

Protein content of grain, a major quality trait, is depended on nitrogen content, enhanced by the Kinetin 10 ppm, its lower doses also improved the per cent value of protein followed by IAA 25 and 50 ppm. Protein content value is also uplifted by the treatment of other growth regulators namely CCC and Ascorbic Acid but in minor way. However, SADH had no any elevating effect on protein content (%). The chief basis of yielding higher protein (Fig.5) is the formation and translocation of huge quantity of amino acids from producer to consumer site in the basmati rice plant. Our result is also similar with the research of Piebiep *et al.*, (2011) [7] in rice, Aldesuquy, H. S. (2001) [1] in wheat, Pandey *et al.*, (2001) [6] in rice, Bakry *et al.*, (2013) [3] in wheat.

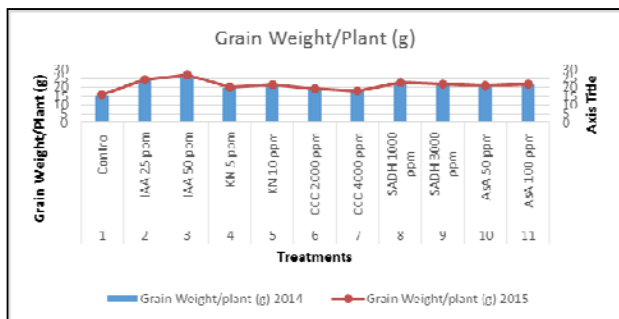


Fig 1

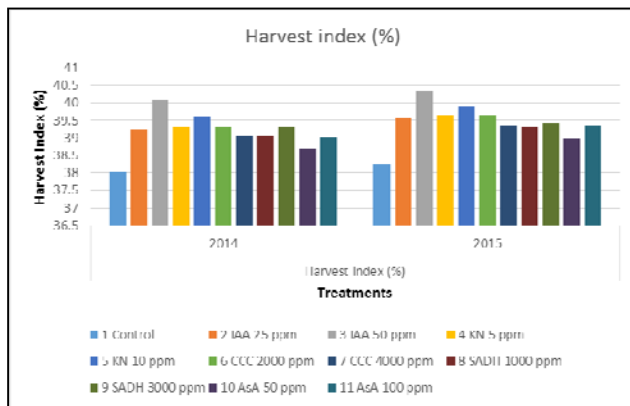


Fig 2

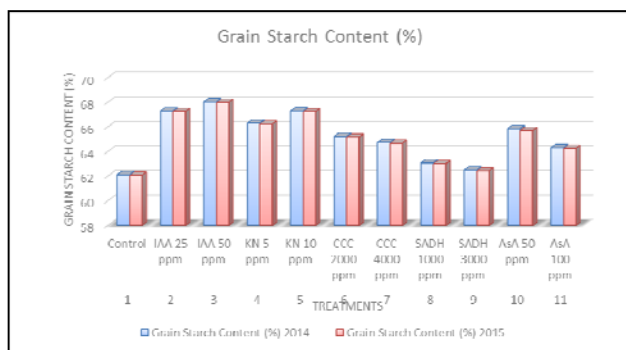


Fig 3

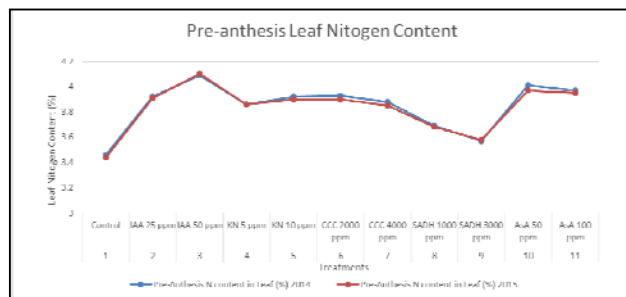


Fig 4

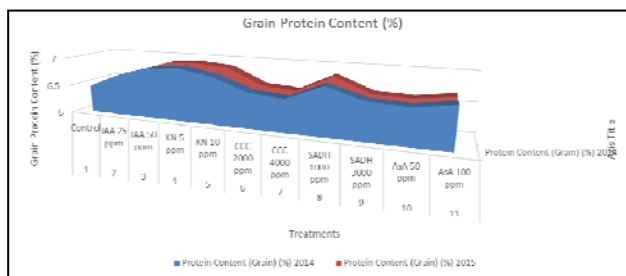


Fig 5

Conclusion

According to above outcome of the experiment, it may be inferred that the foliar application of IAA 50 ppm at pre tillering and anthesis stage appreciated the Grain Weight per plant, Grain Yield, Productivity, Grain Starch Content and Grain Size while Kinetin 10 ppm treatment improved the Grain Protein Content. The enhancement of grain yield of Basmati rice plant was due to increase in number of panicles, number of grains/panicle, grain weight/plant, grain yield and harvest index. Starch content was accelerated due to high dry matter production sand its transport towards sink. Grain size is results due to regulation of cell division in growing grains (formation of sink size). The protein content was enhanced by

Kinetin mainly due to its capacity to produce maximum nitrogen and direct the flow of amino acids through the plant towards the sink. Correlation among different characters of Basmati rice crop were found to be positively and significantly correlated with each other.

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