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EFFECT OF APPLICATION OF "AMINO SIL" ON GROWTH AND YIELD OF RICE

[1,*]Dekhane S. S., [2]Jadhav P. B., [3]Patel D. J. and [4]Manore, R. N.

[1&4]ASPEE, Agricultural Research and Development Foundation, 'ASPEE HOUSE', P.O. Box No. 7602, Malad (W), Mumbai (MH) - 400 064; [2]Chief Agronomist, FarmsonsAgri Solutions Pvt. Ltd., Nashik, (MH) – 422001; [3]Ex. Principal and Dean, B. A. College of Agriculture, AAU, Anand (GJ) - 388 110

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****Corresponding author: Dekhane S. S.,***

ABSTRACT

The present investigation entitled "effect of application of "Amino Sil" on growth and yield of rice was carried out during *kharif* season of the year 2021 on the field of ASPEE, Agricultural Research and Development Foundation, Tansa farm, At- Nare, Taluka- Wada, Dist- Palghar, Maharashtra, India. The experiment was laid out in Randomized Block Design (RBD). The five treatments (Control, Amino Sil @ 1 gm, 1.5 gm, 2 gm and 2.5 gm per liter of water) were replicated four times. The plant height (107.31 cm), number of tillers per plant (12.95),number of panicles per plant (11.1), number of panicles per square meter (277.5) and length of panicle (20.1 cm) was found maximum with application of Amino Sil@ 2.5 gm per liter of water. The highest number of seeds per panicle (181.1), test weight (18.42 gm), grain yield (57.45 q/ha)and straw yield (85.08 q/ha) was found with application of AminoSil@ 2.5 gm per liter water.While, lowest number of seeds per panicle (149.3), test weight (16.39 gm), grain yield (33.66 q/ha) and straw yield (49.6 q/ha) was found in control treatment.The data clearly revealed that, the yield obtained with treatment T4 (Amino Sil@ 2.5 gm per liter water) was significantly higher than all other treatments and also for growth parameters.

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INTRODUCTION

Rice is the most prominent crop of India as it is the staple food for most of the people of the country. Rice crop is the backbone of livelihood for millions of rural households and plays vital role in the country's food security, so the term "rice is life" is most appropriate in Indian context. India occupies an important position both in area and production of rice. By the adoption of improved production technologies such as high-yielding varieties/hybrids, expansion of irrigation potential, and use of chemical fertilizer, supply of rice in the country has kept pace with the increase in demand. Demand for rice is expected to further increase in future as population is continuously increasing, so production of rice also needs to be increased. There is a need to further increase rice productivity because land area under rice cultivation is declining. Major constraints for productivity and sustainability of rice-based systems in the country are the inefficient use of inputs fertilizerincreasing scarcity of water and labor especially for rice cultivation, new emerging challenges from climate change, rising fuel prices, increasing cost of cultivation, and socioeconomic changes such as migration of labor, urbanization, less liking for agricultural work by young youths, women's, and concerns from environmental pollution as well as weather based climatic changes. The only way to sustain rice production for meeting the increasing population demand is to increase the productivity per unit of area of rice with enhanced efficient resource use efficiency. For future productivity gain in rice in India, high-yielding varieties that might have resistance to multiple stresses (abiotic and biotic stress) particularly in the wake of climate change need to be explored. Crop production techniques in rice that could increase factor productivity by efficient utilization of inputs (water, fertilizers, pesticides, etc.) reduce cultivation cost, enhance profit, and provide safe environment must be explored. Encouraging resource conservation technologies and cultivation of climate-resilient high-yielding varieties through demonstrations and making seed available to the farmers will be important to sustain rice production in India.

MATERIALS AND METHODS

The experiment was conducted at ASPEE Agricultural Research and Development Foundation Farm, Village- Nare, Tauka- Wada, district- Palghar in *kharif* season during 2021 in Randomized Block Design (RBD) with four replications (r=4). The plot size was 19.5 m x 14.5 m. The experimental site was located at 19.65^{0}N latitudes and 73.13^{0}E longitudes with average annual rainfall of 3600 mm. Five treatments comprising different levels of Amino Sil such as T_0 - Control, T_1 - Amino Sil @ 1 gm, T_2 - 1.5 gm, T_3 - 2 gm and T_4 - 2.5 gm per liter water were tested inrice grains/crop production. Treatments are given twice by spraying over standing crop. First spray conduct at 40 days after transplanting while second at 75 days after transplanting. Interestingly, the only non-essential nutrient that is included in the guidelines for rice fertilization is silicon (Si). Silicon is the eighth most common element by mass and second most abundant element in soil after oxygen. Rice is considered to be a silicon accumulator plant and tends to actively accumulate Si to tissue concentrations of 5% or higher (Epstein, 2002). Reduced amount of silicon in plant produces necrosis, disturbance in leaf photosynthetic efficiency, growth retardation and reduces grain yield in cereals especially rice. The positive effects of silicon on rice growth and production, manifested when it was specifically supplied during the reproductive growth stage (panicle initiation to heading) than that of vegetative and ripening stages, which exerted a feed-forward effect on photosynthesis coupled with increased in both stomatal conductance and biochemical capacity to fix CO_2 was reported by Lavinsky*et al*., (2016), who surmised that proper levels of Si in reproductive structures played an unidentified role in increasing the yields of rice. Silicon plays an important role in plant growth and development. It increased the photosynthetic rate (Detmann*et al*., 2012), leaf area (Gong *et al*., 2003; Pati*et al*., 2016 and Jan *et al*., 2018) and chlorophyll content (Ranganathan*et al*., 2006 and Song *et al*., 2014).

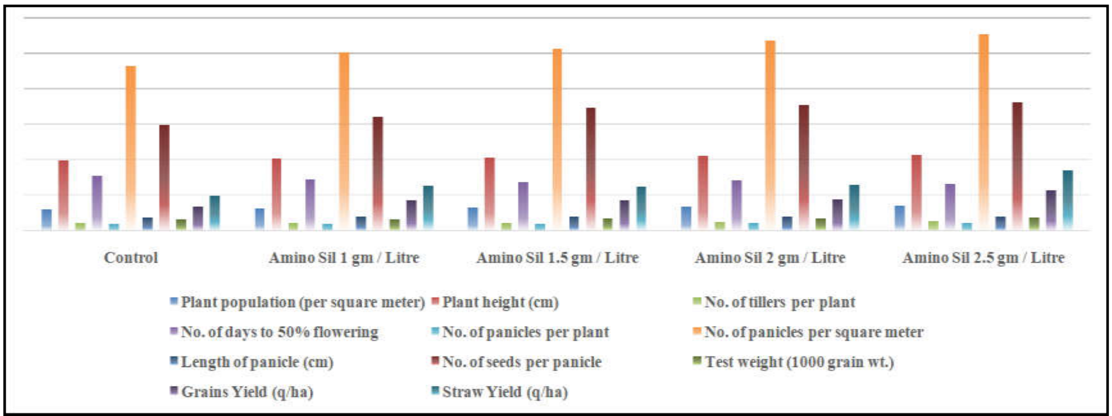
RESULTS AND DISCUSSION

Rice plant has been considered to be a typical siliciphilous plant. It is recognized that silicon promotes photosynthesis, prevents fungal and insect injuries and alleviates lodging. Silicon materials are widely applied to paddy fields to enhanced rice production. The role played by accumulated amino acids in plants varies from acting as osmolyte, regulation of ion transport, modulating stomatal opening, and detoxification of heavy metals. Amino acids also affect synthesis and activity of some enzymes, gene expression, and redox-homeostasis. Amino Acids are also supplied to plant by incorporating them into the soil and through foliar. Glycine and Glutamic Acid are fundamental metabolites in the process of formation of vegetable tissue and chlorophyll synthesis. These Amino Acids help to increase chlorophyll concentration in the plant leading to higher degree of photosynthesis. This makes crop lush Green. Silicon application is more an important in the later growth stages mean at panicle initiation stage. The content of silicon in the hull always much higher in fertile than in sterile panicles, and that the higher silicon content in the fertile panicles due to the transpiration of the panicle. The grain weight increased with the increase in the silicon content of the hull.

Plant growth parameters: The growth period of the rice plant has divided into three stages; vegetative stage, reproductive stage, and ripening stage.

Table No. 1. Effect of application of “Amino Sil” on Growth and Yield of Rice

Treatment	Plant population (per square meter)	Plant height (cm)	No. of tillers per plant	No. of days to 50% flowering	No. of panicle per plant	No. of panicle per square meter	Length of panicle (cm)	No. of seeds per panicle	Test weight (1000 grain wt.)	Grain Yield (q/ha)	Straw Yield (q/ha)
T0	30.75	99.05	10.9	77.75	9.3	232.5	18.8	149.3	16.39	33.66	49.6
T1	32	101.24	11.5	72.25	10.05	251.25	19.4	160.45	16.64	42.68	62.95
T2	33.25	103.19	11.6	68.75	10.25	256.25	19.6	172.95	16.78	42.8	62.16
T3	33.75	104.98	11.9	71	10.7	267.5	19.8	177	17.53	44.85	64.96
T4	34.75	107.31	12.95	66.5	11.1	277.5	20.1	181.1	18.42	57.45	85.08
S.Em.±	0.93	0.96	0.27	3.44	0.21	5.37	0.13	2.35	0.36	4.47	6.46
CD	NS	2.95	0.83	NS	0.66	16.54	0.39	7.24	1.11	13.76	19.9



Graph 1. Effect of application of “Amino Sil” on Growth and Yield of Rice

Silicon also has a major role in increasing yield attributing characters like number of spikelets, filled spikelet percentage, test weight and total grain yield (Rani *et al*., 1997; Ahmad *et al*., 2013; Jawahar*et al*., 2015 and Patil*et al*., 2017) in rice. Rice variety ‘GR-11’ was sown in first fortnight of June during 2021 after seed treatment with the fungicide thiram @ 3 g kg-1 seeds. Twenty five days old seedlings were transplanted at spacing of 20 cm x 15 cm. The bed size was 3.30 m x 3.0 m. Randomly five plants (n=5) were selected from each plot for recorded regular biometric observations from 30 days after transplanting to till harvest. Data were compiled and analyzed using appropriate statistical methods. Keeping in view the above facts, the present study was designed with the objective to study the effect of amino acids and silicon on growth and yield attributes of transplanted ricecrop.

The vegetative stage refers to the period from transplanting to panicle initiation, the reproductive stage from panicle initiation to heading, and the ripening stage from heading to maturity. Fundamental functions of the amino acids in plants are anti-stress agent, chelating agent, cold weather resistance, generative development of plants and improvement of the plant pollen fertility, growth stimulator, precursor of auxin, precursorof chlorophyll, precursor of polyamines: necessary to start the cell division, precursorto the formation of lignin and woody tissues, Regulation of the water balance, reserve of organic nitrogen necessary for the synthesis of other amino acids and proteins, stimulation of the chlorophyll synthesis, stimulationof the ethylene synthesis,stimulationof the germination, stimulation of the hormone metabolism, and stimulation of the resistance mechanism to viruses.

The plant growth parameters *viz*., plant height andnumber of tillers were significantly influenced by various doses of Amino Sil applied in rice. The maximum value of these parameters was recorded with treatment T_4 i.e. AminoSil @ 2.5 gm/liter water which was at par with treatments T_1, T_2 and control T_0 . These are in agreement with the findings of Detmann*et al*., (2012) and Lavinsky*et al*., (2016) who demonstrated that Si played an important functions in enhancing the sink size and strength, which in turn, exerted a feed-forward effect on photosynthesis that coupled with increased in both stomatal conductance and biochemical capacity to fix CO_2 when Si is specifically supplied during the reproductive growth stage (panicle initiation to heading) of rice. This might be due to Si fertilization improving the resistance to lodging and also increases the erectness of leaves and leaf blades; which allow better light transmittance through plant canopies and thus indirectly improve whole-plant photosynthesis in rice (Savant *et al*., 1997; Tamai and Ma, 2008). Application of Amino Sil didn't show any significant effect on plant population and number of days to 50% flowering.

Yield parameters: Yield contributing parameters such as number of panicles per plant, number of panicles per square meter, length of panicle, seeds per panicle, test weight, grain and straw yields were measured at harvest of the crop. The result in table 1 andGraph 1 indicated that different treatments induced marked variations in number of panicles per plant, number of panicles per square meter, length of panicle, seeds per panicle, test weight, grain and straw yields. Highest values of all these parameters were found with treatment T_4 (AminoSil @ 2.5 gm/liter water). The highernumber of panicles per plant (11.1), number of panicles per square meter (277.5), length of panicle (20.1 cm), seeds per panicle (181.1), test weight (18.42 g), grain (57.45q/ha) and straw (85.08 q/ha) yields were recorded in treatment T4*i.e*. application ofAminoSil @ 2.5 gm/liter water. Yield attributes *viz*., number of panicles per plant, seeds per panicle, test weight and grain yield per panicle were significantly affected by Silicon in rice. Silicon application increased the number of spikelets per panicle of rice particularly applied during reproductive stage. This might be due to increased synthesis of carbohydrates and that might have increased the sink size and capacity. Silicon fertilizer, that may significantly reduce empty spikelet's number in rice and increase fertility, increased spikelets per panicle that ultimately increased crop yield. The contribution of carbohydrates from photosynthetic activity for longer period might have resulted in efficient translocation of food material into the sink (grain) thereby increased the number of filled grains percentage. Grain yield per panicle of rice also increased by silicon than controls (without silicon). Similar results were observed earlier by Jawahar*et al*., (2015). It was reported that silicon is responsible to control stomatal activity, photosynthesis and water use efficiency which ultimately results in better vegetative and reproductive growth which ultimately increased the panicle weight.

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