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Aromatic Rice in North-Western Plain Zone of India

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Rice (*Oryza sativa* L.) is one of the most important field crops after wheat in the world providing staple food to the millions. It is an indispensable source of calories for almost half of the population with in Asia. More than 90% of the world rice is produced and consumed in Asia, which is a native for 60% of the earth's population. Rice is the first most important crop in India where it is grown in an area of 43.9 million ha^{-1} with a total production of 106.77 million tones and an average productivity of 24.32 q ha^{-1}. India is first in terms of area (44 million ha) and second in production (148.3 million tonnes). However, the average productivity of paddy in India is only 3.36 tones ha-1 compared with a world average of 4.30 tonne ha^{-1}. Basmati rice is primarily grown in north-western India and Pakistan. These ricecultivars are preferred for their long and slender kernels, which expand to 3-4 times their original length and remainfluffy on cooking. Paddy (rice) soils are usually deficient in organic matter because of high temperature and moisture, which causes rapid decomposition of organic matter. Aromatic rice constitutes a small but special group of rice, which is considered best for aroma, superfine grain and cooking qualities. There are many known groups of aromatic varieties such as Basmati rice from India and Pakistan and Jasmine rice from Thailand. These groups and varieties differ greatly in the grain length, shape, weight, density and in their cooking and eating quality within the group. Aromatic rice has occupied a prime position in society for aroma, milling, cooking and eating qualities and has been considered auspicious. Rice crops in the world. As such, it is a staple of over a half of the world's population, mostly in Asia. Rice is the second most cultivated cereal after wheat. It provides 20 percent of the per capita energy, and 13 percent of the protein consumed. In India, zinc is considered as the fourth important yield limiting nutrient after nitrogen, phosphorus and potassium respectively. The critical limit of available zinc in the soil suitable for rice growth is 0.6 mg kg^{-1}. The plant available zinc in Indian soils extracted with DTPA is less than 1% of total zinc. Rice (*Oryza sativa L.*) is the dominant staple food for more than 50 percent of world population and India ranks first in the world in terms of area of rice cultivation with 44.6 m ha and second in productivity of 2.96 t ha^{-1}. Soil application of zinc increased the grain yield and foliar application of zinc increase the grain zinc concentration. When rice was grown in different types of soil, up to 90 percent difference was observed in the grain Zn concentration in the same rice varieties. Silicon is an important micronutrient for healthy and competitive growth of all cereals including rice in Asia. Role of silicon in plant health and growth has been investigated in silicon accumulating crops and it seemed significantly effecting. Research evidences proved that adequate uptake of silicon (Si) can increase the tolerance of agronomic crops especially rice to both abiotic and biotic stress. Effects of silicon on yield are related to the deposition of the element under the leaf epidermis which results a physical mechanism of defense, reduces lodging, increases photosynthesis capacity and decreases transpiration losses. Rice is one of highly sensitive crops to Zn deficiency and Zn limits growth and yield of rice. Zinc deficiency in rice has been widely reported in many rice-growing regions of the world. In India 47 percent and in MP 60.3 percentof the soils found deficient in Zn. Paddy soil conditions are usually not favorable for the availability of zinc and hence zinc deficiency has been reported countrywide in rice soils. Silicon (Si) is the second most abundant element in the earth's crust and considered as a beneficial element for crop growth, especially for crops under *poaceae* family. Rice is a typical silicon accumulating plant and it benefits from silicon nutrition. Its supply is essential for healthy growth and economic yield of the rice crop. Silicon interacts favorably with other applied nutrients and improves their agronomic performance and efficiency in terms of yield response. Also, it improves the tolerance of rice plants to abiotic and biotic stresses. Hence, silicon management is essential for increasing and sustaining rice productivity. Accumulation of Si in leaves and tissues in addition to conferring resistance against fungal diseases and insect pests, can improve erectness of leaves, increase yield and alleviate water stress, salinity stress and nutrient deficiency or toxicity stresses as well. Silicon is also considered as an environmentally-friendly element in relation to soils, fertilizers and plant nutrition. In modern agriculture, Si has already been recognized as a functional nutrient for a number of crops, particularly rice and sugarcane, and plays an important role in the growth and development of crops, especially gramineae. The hulls of poor-quality and milky-white grains (kernels) are generally low in silicon content, which is directly proportional to the silicon concentration in the rice straw.

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Received January 01, 2021; **Accepted** January 16, 2021; **Published** January 22, 2021

Citation: Singh S (2021) Aromatic Rice in North-Western Plain Zone of India. J Rice Res 9: 231.