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# Evaluate the interaction effect of potassium on extent of fruit colour in litchi

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**Abstract**
The present investigation was carried out to evaluate the interaction effect of potassium on extent of fruit colour in litchi during the year 2019. Ten years old uniformly grown "Deshi" litchi plants established at Fruit Research Station of Bihar Agricultural University Sabour, were Sprayed with $K_2SO_4$ and KCl @ 0%, 1% and 2% at two different stages i.e. Marble and Stone hardening. The plants treated with potassium as foliar feeding significantly improved fruit skin colour and quality attributes over the control. Anthocyanin content higher with $K_2SO_4$ application at stone hardening stage. So, it is concluded that $K_2SO_4$ @1% and 2% at stone hardening stage significantly improved anthocyanin content litchi cv. Deshi. Fruit quality characteristics viz. total sugars, reducing sugar were also enhanced with marble and stone hardening stage with sprays of different concentrations of potassium fertilizers over untreated trees. So, it is concluded that $K_2SO_4$ @1% and 2% at stone hardening stage significantly improved total sugar, reducing sugar and anthocyanin litchi cv. Deshi.

**Keywords:** Litchi, potassium, stage, dose, anthocynin

## 1. Introduction

Litchi (*Litchi chinensis* Sonn.) recognized as "Queen of the fruits". It is an important sub-tropical evergreen fruit crop belongs to the family Sapindaceae. It is native of south China. Its fruits are rich in sugar contents and it varies from 6.74-18.0%, acid content 0.20 to 0.64% in the form of malic acid and also possesses citric acid, levulinic acid, phosphoric acid, glutamic. Wang *et al* (2010) [12] reported that water soluble alcohol extracted from litchi skin significantly inhibited in vitro growth of human hepatoma cells and suppressed cancer development particularly effective in the breast cancer. Its skin also contains free radical scavenging compounds like ascorbic acid, carotenoids, polysaccharides (Yang *et al* 2006) and phenolic substances flavonoids (flavonols and anthocyanins) and phenolic acids. Litchi has ensure high economic productivity and retain the optimum nutrients in the soil at the desired level correct doses of manures and fertilizers must be applied on the basis of long term fertilizer experiments and choose of reliable diagnostic tools (Bhargava *et al* 1993) [2]. Generally fruit plants require sixteen mineral elements for various physiological processes whereas N and K are required in sufficient amount for the production of quality fruits. It is postulated that 10 MT litchi fruits annually remove nearly 67 kg N, 16 kg $P_2O_5$ and 73 kg $K_2O$ from the soil. It is therefore essential that litchi trees should be supplied with adequate nutrients for fruit production as limited supply of macro and micro nutrients in the soil is responsible for poor fruit yield and quality (Menzel and Simpson 1987). Zhang *et al* (2004) observed that nutrition plays a significant role in improvement of litchi flowering, fruiting and productivity. Roy *et al* (1984) [8] studied the correlation between "Bombai" litchi fruits with leaf N, P and K contents and reported that fruit yield was related to leaf Nitrogen content at the time of flowering and harvesting and with leaf Potassium content at fruit harvest. It has been also observed that leaves and fruit absorbed most of the nutrients within 24-72 hours after spray and thereafter depletion of leaf nutrients content was noted due to translocation of N, P and K to the active developing organs in plant system (Singh *et al* 2007) [9]. Yang *et al* (2015) [13] conclude that fruit potassium fertilizer (40%) should also be applied during the fruit enlargement period to promote litchi fruit expansion and to improve litchi yield and quality.

Potassium is one of the essential nutrient required for numerous biochemical and physiological processes vital to plant growth, yield, quality and stresses. In horticultural crops potassium improves fruit yield, fruit size, soluble solids concentrations, ascorbic acid, colour, shelf life (Geraldson 1985, Lester *et al.* 2007) as it concerns with the process of phosphorylation, transportation of photo assimilates from source tissues via the phloem to sink tissues, enzyme activation, turgor pressure, transpiration, photosynthesis and stress tolerance (Usherwood 1985, Pettigrew 2008). Potassium is involved in the translocation of sugars, formation of carbohydrates and regulates root hydraulic conductivity and provides resistance against pest, diseases, drought and stress (Imas and Bansal, 1999). Southwick *et al* (1996) suggested that potassium intake from foliar feeding is more efficient than soil application. However, tree metabolic functions should be improved and ineffective rate of respiration also reduced by using an appropriate potassium fertilizer, which is in turn essential for the improvement of the trees carbohydrate supply, accumulation level, fruit setting and yield (Deng *et al* 1994) [3]. The relationship between the leaf nutrients and fruit quality attributes showed positive relationship between leaf K, anthocyanin content and titrable acidity, leaf N and leaf Ca and fruit firmness (Siva kumar and Korsten 2007) [10]. The adequate information of foliar applications on fruit parameters in litchi cultivars is lacking under Bihar conditions.

**Materials and Methods**

The material and methods employed during the investigation are described here under. The present studies were carried out on 10 years old fully mature uniform healthy plants of litchi cultivar "Deshi" planted at 10.0 m x 10.0 m. The uniform cultural practices were given to all the plants as per recommendation of Package and Practices for Fruit Crops of Bihar Agricultural University Sabour. The experiment was layout by Factorial Randomized Block Design (FRBD) and plants were (in addition to soil application of recommended doses of fertilizers) sprayed with different concentrations 0%, 1% and 2% ($D_0$, $D_1$, and $D_2$ respectively) of $K_2SO_4$ (48%) and KCl (60%) ($K_1$, $K_2$ respectively) at two different sub treatments stages i.e. Marble stage ($S_1$) and Stone hardening stage ($S_2$). Each treatment was replicated three times. The plants were sprayed with hand operated Knapsack sprayer during early morning hours after dissolving calculated dose of respective treatment.

**Climate and weather conditions**

The climate of the tract is typically subtropical characterized by aridity of the atmosphere, scarcity of water, with extreme temperatures both during summer and winter. Maximum temperature in summer ranges between 35 to 39˚C whereas, in winter temperature falls down from5 to 10˚C. The average rainfall 1231.4 mm, most of which is received in rainy season from July to September.

**Total sugars (%)**

The estimation of total and reducing sugars was done by using method suggested by Lane and Eynon (AOAC, 1990).

**Total Anthocyanin (mg/100g)**

Ten gram of the sample was crushed with 10ml of ethanolic HCl with the help of pestle and mortar and transferred into 50 ml conical flask using 10 ml ethanolic HCl for washing. The solution was stored overnight afterwards solution was filtered with Whatman No.1 filter paper. Final volume was made up to 100 ml and stored in dark for 2hs. Absorbance was recorded at 535 nm.

**Results and Discussion**

The maximum total sugar was found with $K_2SO_4$ @ 2% and minimum with KCl @ 2%. However, the dose of potassium did not showed any significant difference for total sugar. Application of potassium either at marble or stone hardening stage have any significant difference. The results are in accordance with the findings of Ahlawat and Yamdagini (1981) [1] who observed that increased total sugar with potassium in guava fruits might be attributed to higher assimilating power of leaves over longer period resulting in increased availability of sugars to fruits. Potassium is known to enhance photophosphorylation and dark reaction of photosynthesis resulting in increased accumulation of carbohydrates. Similarly according to Taiz and Zeiger (2004) [11] the efflux of sucrose to the apoplast is facilitated by potassium availability which thereby increases sugar translocation from source to sink tissues promoting their growth. Pathak and Mitra (2010) [7] concluded the similar results that fruits from the plants receiving 800 g Potassium chloride in two splits at 15 days after fruit set and 30 days before flowering showed the maximum reducing sugar (14.65 %) content of fruit. Various other researchers reported similar findings of increase in reducing sugar content with K application Kumar *et al*., (2006) in "Alphonso" mango.

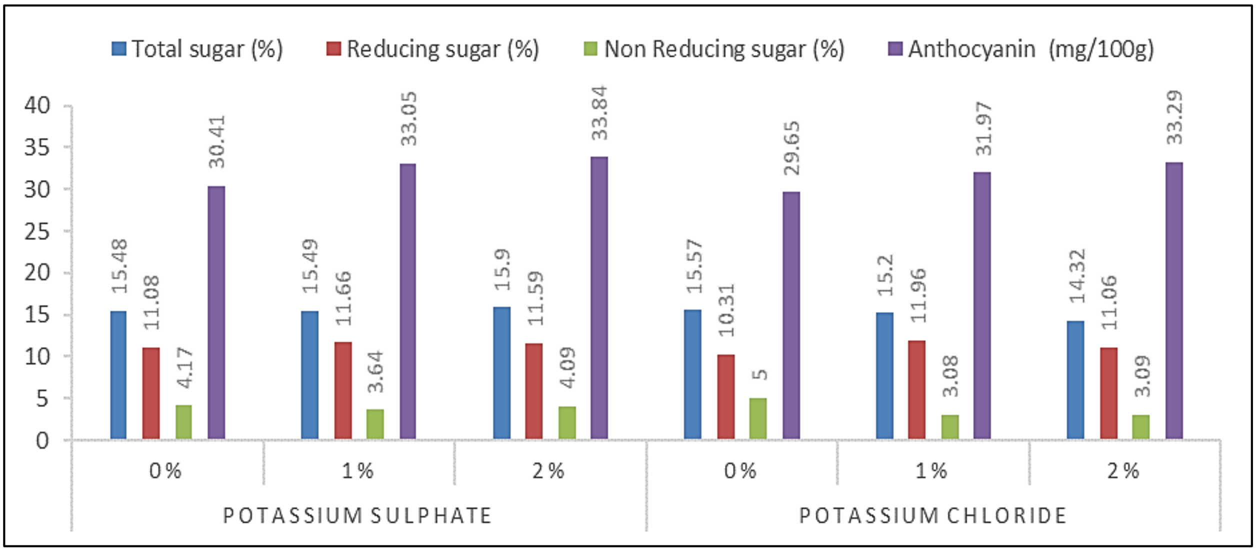


**Fig 1:** Interaction effect of potassium with doses

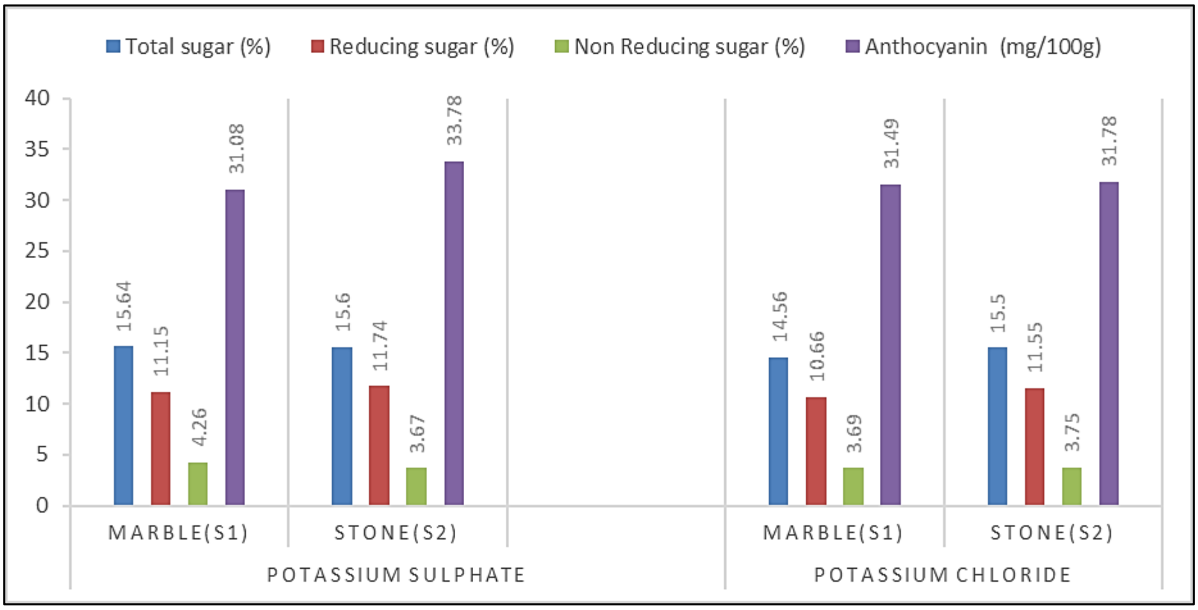


**Fig 2:** Interaction effect of potassium with stages

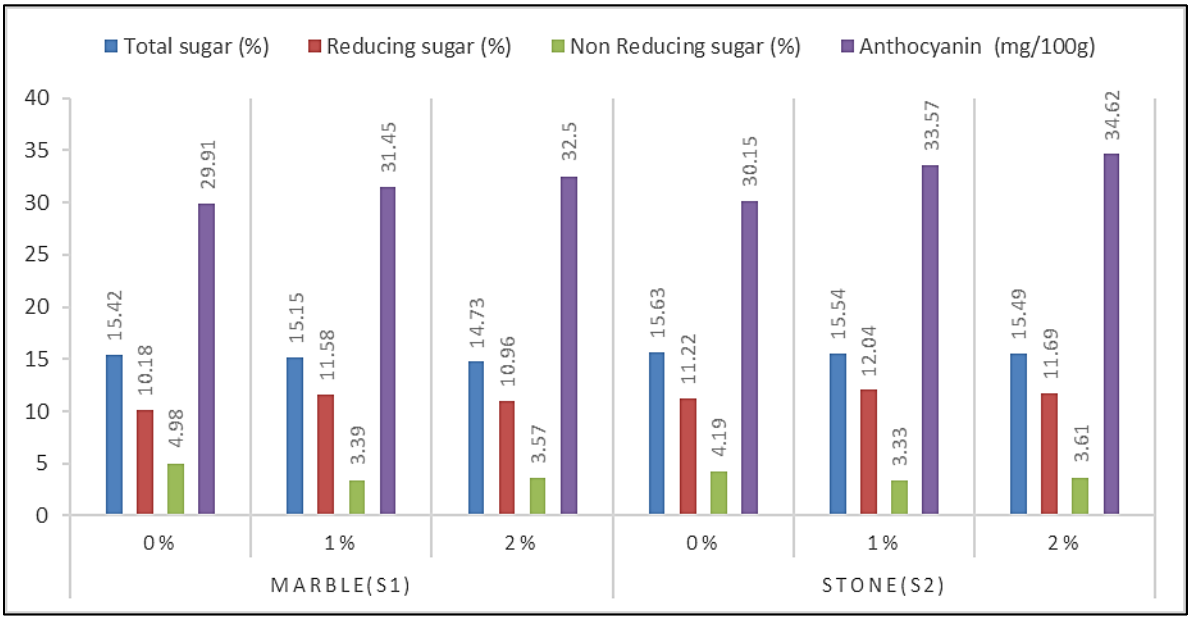


**Fig 3**: Interaction effect of stages with doses

The highest anthocyanin content was observed with $K_2SO_4$ applied at stone hardening stage and minimum with control while as source of potassium and its concentration do not registered any significant differences. Potassium play important role in bio synthesis pathway of anthocyanin. The findings are in confirmation with the literature as suggested by Fisher and Kwong (1961) [4] that improvement in colour was noted with application of K fertilization might be due to increased in carbohydrates accumulation in the fruits. In peaches Trevisan *et al.*, (2006) reported that soil application (1200 g of KCl + 10 g KCl) as foliar application combined with vegetative pruning improved red coloration of fruits.

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