

THE NEGLECT OF POTASSIUM: NECESSITY OF K FOR CROP SUSTAINABILITY A REVIEW

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Abstracts: In ancient time, agriculture was more or less sustainable due to regular organic fertilization. Due to various economic constraints, farmers are forced to apply agrochemicals that give higher returns resulting in relatively high N input and a coincidental decrease of other nutrients including K. This situation is accompanied by negative K balance for many agricultural regions and indicates only a short- term consideration. A long term neglect of K would result in a non-sustainable situation for crop productivity.

Keywords: Productivity, Crop, Potassium, Agrochemicals

INTRODUCTION

From the various physiological functions of K in crop production, particularly, in avoidance of various biotic and abiotic stresses, it can be concluded that the practice of imbalanced fertilization with the neglect of proper K fertilization will result in increasing problems, particularly, under stress- prone environments. Innovative K fertilization management strategies have to be developed to efficiently counteract the decline in crop sustainability due to an imbalanced fertilizer use.

As shown in Fig.1 the agricultural growth trend peaked in 1980's and has declined since then (Ahluwalia, 2005). The response ratios appreciated with a rising trend only when chemical fertilizers were supplemented with multi-nutrient source of organic manure. In a long term fertilizer experiment (LTFE- ICAR), the response ratios to applied nutrients were computed for rice, wheat maize and finger millet in different places, the application of N alone caused reduction in response ratio, primarily due to deficiency of P and K. The response ratio increased with the application of P along with N, but its reduction with time was again conspicuous in the absence of K application (Samra, 2006).

Importance of K on Yield

Prasad (2006) reported that except for pulses, the production growth rates during 2000- 01 to 2002-03 for all crops are negative. As regard the productivity during this period, it is negative for all the crops except wheat. Xiong *et al.* (2000) reported that purple soil, which is K-rich soil, when fertilized with potassic fertilizer, increased the rice yield from 6.8 to 14.7% and denoted that the input of K has been one of the factors or potential factors for high yield. Saxena (1995) clearly indicated that wheat yields become uneconomical after 5 years when only N

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fertilizer is applied. Even annual field application of NP fertilizers is insufficient to sustain yields over long term. The increasing trend in response to K over the years suggests the need for its application in intensive rice- wheat cropping system. Malakouti *et al.* (2005) reported the synergistic interaction between K and Zn on yield increase of wheat and rice.

Disease Resistance

Christensen *et al.* (1981) reported that KCl together with ammonium fertilizer suppressed take- all disease. Prabhu *et al.* (1999) reported that the K-fertilization in absence of additional N greatly decreased panicle blast. The response was significantly linear and negative with increasing levels of K. On the other hand, the response of panicle blast to different levels of K was quadratic at 30 kg/ha of N. Disease severity increased as the N rate increased from 0- 60 kg/ha and decreased at rates above 60 kg/ha. Malakouti *et al.* (2005) reported that potassium along with Zn also reduced concentration of pollutants such as nitrate (NO₃) and cadmium (Cd) in the edible parts of the plants.

Quality of Crops

K increased significantly the yield and quality of tomatoes, higher % of marketable tomatoes were obtained from K treatments as compare to control; and MOP sources gave better results than SOP. K as MOP had positive effect on vitamin C (Akhtar *et al.*, 2003). Jeyakumar *et al.* (2001) reported that potassium nutrition significantly influenced fruit weight, fruit yield/plant and the quality of the fruits including the quality of the latex.

Stress factor

Cakmak *et al.* (1994) reported that the photo-oxidative damage to the chloroplast is a key process in the occurrence of leaf symptoms under conditions

of Mg or K deficiency. Leaf chlorosis, such as found in K and Mg deficient plants, is not typical of P deficient plants. Because of the distinct effects of Mg and K on photosynthetic carbon metabolism, photo-oxidative damage in plants grown under marginal conditions, such as drought, chilling, and salinity can be exacerbated when the soil supply of Mg or K is low. Even K-rich clay soil requires a regular K fertilization particularly under frequently occurring adverse soil conditions with inhibited replenishment and acquisition of K. Jensen *et al.* (2003) reported that legumes (Pea, Red Clover, Lucerne) accumulated large amount of N but lower amount of K than ryegrass, barley and rapeseed. Rye had an outstanding root surface, which in total and per unit root matter was twice than other crops. Crops modify their root hair length as response to low K conditions and maintain the uptake from soluble K sources.

Effect on Soil

Santhy *et al.* (1998) reported that the continuous cropping and fertilization had a deleterious effect on total K level of the soil, application of K fertilizer at 150% optimal level could maintain the initial status of the total K. Sharma *et al.* (2002) reported that the organic carbon, microbial biomass carbon and microbial count increased with the application of recommended NPK+ FYM compared to NPK, NP or N alone in a long term experiment on *Typic Hapludalf* at Palampur. Similarly, different K fraction *viz.*, WS-K, NH₄OAc-K, Exch.-K, HNO₃, Non-exch.-K and TK-K was gradually decreased in 2007 from its base year values *i.e.* 2003 under FYM (0 and 10t/ha) and NP application (0,50, 100 and 150% RD) at different depth of soil profile under Bajra-Mustard- Cowpea cropping system at Anand (Anon. 2008).

Potassium Balance in soil

Apparent potassium use efficiency of applied K in the 100% NPK treated plot was about 45.6% which increased to 55.6 % in NPK 100% + GM and 54.4% in 100% NPK + FYM treated plots. This could be due to higher crop removal of sol potassium and its available content in all the treatments (Yaduvanshi and Swarup, 2006). Nambiar and Ghosh (1984) shown K balances from two long term experiments in middle and lower Gangatic plains (West Bengal) in which treatments consisted of increasing levels of NPK, the higher K levels applied due to smectite nature of clay minerals resulted in K balances ranging from 0 to 75 kg K/ha. In sharp contrast K balances in illitic soils in pantnagar were highly negative even at low K application levels.

CONCLUSION

Application of only NP fertilizers is insufficient to sustain yields over long term. A long term neglect of K would result in a non sustainable situation for crop

productivity. The application of K not only helps to increase crop yields in balanced application of nutrients but also improves crop quality, storage besides imparting resistance against drought and certain pest and disease.

Future Needs

Long term studies to monitor the effects of nutrients management in different agro- eco region and major cropping systems.

Ways and means of offset nutrient depletion: because application of nutrients as current recommendations seems to be insufficient.

Accurate nutrient balance sheets to be worked for the various agro- eco regions.

Development of farmer- friendly plant diagnostic technique that aids a rapid correction of limiting nutrient.

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