BORON INCREASES THE GROWTH AND YIELD OF MUNGBEAN

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ABSTRACT

Pulses have significant role in the profitability of agriculture because of major proportion of our population depends on it due to its higher nutritional value, rich source of protein and low price. Pulses are also important component of animal feed and their dried straw is used as hay. In pulses, mungbean (*Vigna radiata* L.) is a vital crop. Boron has positive effect on growth and development, nitrogen assimilation and root growth. Low level of boron causes negative impact on growth, narrow leave expansion, restricted root elongation and morphological features of mungbean plant.

Key words: Boron, assimilation, expansion, nutritional value and morphological features.

INTRODUCTION

Boron ranks third among the micronutrient and has a chief role in plant cell wall and membrane constancy (Bassil *et al.,* 2004). It increases the yield and growth of plants by increasing the leaf area expansion, 1000 seed weight, nodule formation, seed yield and biological yield. It influences the major cellular functions and metabolic activities in plants and required for cell differentiation at all growing tips of plants (meristems) where cell division is active (El-Hamdaoui *et al.,* 2003). Kaisher *et al.* (2010) studied the effect of boron on pulses and concluded that it is important for protein synthesis and improved protein content. According to Renukadevi *et al.* (2002) boron application maximize the light interception ratio, biomass production, leaf area index, net assimilation rate, crop growth rate and seed yield in pulses. Among pulses, mungbean is an important pulse crop. It is a rich source of protein, easily digestible, animal feed as protein concentrates and also plays an important role in human and animal diet. It contains 24.2 % protein, 60.4% carbohydrate and 1.3% fat (Afzal *et al.,* 2004). According to Reddy *et al*. (2003) combined effect of boron with different growth regulators is effective in improving the translocation of photo-assimilates which improve the grain yield and harvest index. Plant weight, plant height and numbers of nodule were increased by the application of 1.0 lb B acre^{-1}. Soybean yield increased from 8.2 to 11.8% over the control by boron application (Ross *et al*., 2003). It influences the pollen producing capacity, pollen tube growth, anther viability of pollen grain and pollen germination. Pollen tube grows well by the application of boron because pectin is internalized by cross-linking with boron which increases the number of seeds pod^{-1} in mungbean. Hence, number of pods per plant, number of seeds per pod and seed yield enhanced with increasing the boron availability (Verma *et al.,* 2004). Patil *et al*. (2006) investigated that application of boron 6 kg ha^{-1} and 25 kg Zn ha^{-1} significantly improved the seed yield of mungbean over control. Low concentration of boron bounds the nitrogen fixation in legumes by restricting the nodule formation and nitrogen fixation increased with higher boron concentration (Yakubu *et al*, 2010). Rashid and Rafique (2005) found the critical B concentration with respect to plant age in weeks. They considered that 1.0 mg B kg^{-1}of soil produced maximum crop biomass and above that concentration produced toxicity. Adiloglu and Adiloglu (2006) concluded that shoot dry matter significantly reduced with boron application whereas increased with Zn application. The deficiency of boron inhibited the growth by which reason reduction in root to shoot ratio and limited the P, K and Fe contents in both root and shoot of plant. When boron supply was limited poorer calcium content was observed in shoot, whereas boron supplied, the calcium content in plant was increased. Nabi *et al*. (2006) checked the effect of boron on growth and production of mungbean. They examined a notable increase in height, leaf area and biomass production of mungbean by the application of boron. Results revealed that maximum leaf area, plant height, seeds per pod and 1000 grain weight was obtained at 4 kg B ha^{-1} while maximum dry matter production was observed at 2 kg B ha^{-1}

Chowdhury *et al.* (2010) proved that plant height, total dry matter; number of pods per plant, number of seeds per pod, 1000-seed weight and seed yield was enhanced with exogenous application of boron. Saleem *et al*. (2010) checked the effect of boron sources (borax and colemanite) under flooded condition. They concluded that growth and yield equally affected by both sources of boron (borax @ 2 kg ha^{-1} and colemanite @ 3 kg ha^{-1}). Jabeen and Ahmad (2011) concluded that boron, Mn and their mixture have positive effect on growth parameters and biochemical activities under saline or nonsaline condition. The growth and yield components were improved with mixture spray of both elements instead of single element. Ayvaz *et al.,* (2012) studied the effect of boron on barley and concluded that plant growth and development declined with increasing boron concentrations. Muhammad *et al.* (2013) reported that shoot and root fresh and dry weights decreased with increasing the concentration of boron. According to Metwally *et al.* (2012) that regular reduction in shoot-root fresh and dry matter was observed with rising boron concentration in sand culture media. Ashagre *et al.* (2014) concluded that germination percentage, shoot and root lengths, fresh and dry weights, root - shoot ratio and seedling vigor index were decreased beyond 0.25 mg/L, and phyto-toxicity increased with raises in concentration of boron. The maximum shoot fresh weight; shoot and root dry weights, seedling dry weight and the lower shoot toxicity index were observed in low boron concentration (0.25 mg/L).

According to Vyakaranahal *et al.,* (2001) germination percentage, seedling vigor index, seedling dry weight, 1000-grain weight and seed yield per plant improved by application of boron. Renukadevi *et al*. (2002) concluded that soil applied boron boost up the seed yield and high protein contents in mungbean. Maximum seed yield (1082 kg ha^{-1}) as well as harvest index (18%) was noted in treatment 4kg ha^{-1} and 8kg ha^{-1} respectively. Kulkarni *et al.* (2002) stated that micronutrients contribute in yield maximization. Maximum economic yield (1722 kg ha^{-1}) was recorded in foliar applied boron treatment then foliar spray of $MgSo_4$ (1655kg ha^{-1}), $FeSo_4$ (1641 kg ha^{-1}) and control (1580 kg ha^{-1}). Abd El-Wahab, (2008) reported that unsaturated fatty acids e.g. palmitic and stearic increased by the application of sulphur and boron. Haider, 2011 concluded that boron at the rate of 4 kg ha^{-1} enlarged the plant height, number of seeds per pod, 1000-grain weight, seed yield and protein contents. Mehmood *et al.* (2011) investigated the effect of boron and stated that number of nodules, weight of nodules and size of nodules improved by treatment (2.86 mg B l^{-1}) while high concentration (4.86 mg B l^{-1}) showed adverse effect and significant reduction in nodule weight, size and numbers of nodule as compared to control. Bilen *et al.* (2011) observed the boron effect on soil microbial population and enzymatic activity. The results showed that maximum microbial activity was found at 3 kg B ha^{-1}. Enzymatic activity of urease, de-hydrogenase and phosphatase showed a significant and positive correlation with boron application. Maximum urease activity was observed at 6 kg B ha^{-1} while dehydrogenase at 3 kg B ha^{-1}. Subedi and Yadev (2013) performed a field experiment to determine the effect of sodium molybedate and boric acid as seed primer on production of mungbean. Nutrient solution 250, 500 and 750 ppm (500 ppm of sodium molybedate mixed with 500 ppm boric acid), water primed and unprimed were applied. They exposed that seed emergence on priming with nutrient solution was significantly increased as compared to unprimed but flowering and maturity showed non-significant results. Maximum grain yield (1583 kg ha^{-1}) was attained at 250 ppm boric acid as weigh against unprimed (1237 kg ha^{-1}) and priming (1318 kg ha^{-1}). Renukadevi and Savithri, (2003) reported that quality of mungbean was increased with rising level of boron. Soil applied boron at the rate of 2.0 kg ha^{-1} showed maximum harvest index (18.25%); seed yield (1073.44 kg ha^{-1}) and seed protein contents (20.51%). Shekhawat *et al.* (2008) concluded from experiment that boron and sulphur enhanced the yield, yield attributes and quality of mungbean.

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