Abstract

Drought has posed a threat to the security of the world's food supply, more particularly in areas with significant agricultural production. Regional response to drought stress depends greatly on the rainfall and temperature, the availability of groundwater, and the soil properties. Moreover, factors such as economic growth and irrigation infrastructure determines the crop loss due to drought. The mung bean (*Vigna radiata* L.) has a long history of use as traditional medicine and is significantly consumed pulse all over the world, particularly in Asian nations. It is a well-known source of protein, dietary fiber, minerals, vitamins, and significant quantities of bioactive compounds, such as polyphenols, polysaccharides, and peptides. Whereas, *Lathyrus sativus* is one such legume that is thought to cause nutrient deficiency among the consumers of South Asian countries owing to higher phytic acid content. The changes in water regimes may also trigger the formation or transformation of different species of nitrogen and phosphorus in the soils. The changes in soil microbial population or diversity due to drought may hamper the N or P mineralization rates and thus their availability to the plants. Moreover, the aerobic conditions under drought also influence the transformation of N and P species by affecting their oxidation-reduction. Amongst various strategies to mitigate the impact of drought in agriculture, application of soil amendments such as biochar and FYM is gaining popularity. However, studies on beneficial impacts of these soil amendments on crops are confined to yield and health of the crops.

Therefore, a greenhouse study was conducted in Khetri, Assam, to study the influence biochar or FYM as soil amendment and imposition of drought (at two different crop growth stages) under two legume cultivation (viz. *Vigna radiata* L. and *Lathyrus sativus*) with the following objectives:

1. To observe the soil nitrogen and phosphorus mineralization:
    a. under water deficit condition
    b. as influenced by organic amendments under water deficit condition
2. To study the management induced changes in soil biological properties under water deficit conditions.
3. To assess the impact of management induced responses on grain quality of legumes.

The results thus obtained delineate that application of FYM at the rate of 1t ha^{-1} led to higher increment (65%) of ammoniacal N, nitrate N (2.4×), microbial biomass N (124%), total soil N (100%), and SOC (50%) when the crops were exposed to drought as compared to biochar. Similarly, application of FYM at the rate of 1t ha^{-1} and exposure to drought revealed enhanced labile P (6×), and reductant soluble P (1.5×). However, under similar conditions, biochar application at the rate of 1t ha^{-1} revealed a higher enhancement in Al-P (2.3×), Fe-P (45%), and Ca-P (37%). Application of FYM also revealed positive impacts on soil biological properties under drought and led to a higher increment in activities of soil enzymes arylsulphatase (40%), dehydrogenase (123%), FDA hydrolysis (71%), acid phosphomoesterase (69%), and microbial biomass carbon (50%) as compared to biochar application. Moreover, the positive impact of FYM was also documented in grain quality of both the crops exposed to drought with significant increases noted in grain carbohydrates (96%), in vitro protein digestibility (42%), grain prolamin (23%), glutelin (28%), and mineral contents.

The transformations of nitrogen and phosphorus in soil during drought have significantly altered by soil amendments. However, the responses are very much crop specific and can vary even within the same crop family. Performance of FYM as a soil amendment was found superior to biochar in enhancing soil biological properties as well as the grain quality of the crops when subjected to drought. Increased grain phytic acid content under application of soil amendment brought attention to the significance of grain quality assessment if soil amendments are applied during drought.