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Soil phosphorous enrichment by buckwheat along with its ability to suppress weeds by allelopathic effect

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Abstract

Human diet needs to be revolutionized and should start exploring new food habits which are beneficial in multiple ways for both human mankind and ecosystem, starting with the problems faced by human for depending on only specific crops like rice, wheat, maize, are the nutritional deficiencies in the crop and also some health implications like diabetes caused by prolonged consumption of rice, buckwheat has lower Glycemic index compared to rice, we can adapt for cultivation and consumption of buckwheat as an alternative of this crops, for its unique ability of its roots to solubilize soil phosphorous which will not only enhance P content in soil but also help succeeding crop to utilize the solubilized P, for this it's called as P "scavenger" crop, which cannot be performed better by other crops as buckwheat does and also for its unique medicinal values with the absence of gluten and the presence of rutin which is obtained from the leaves, plays a key role in preventing rupture of arteries and also the tender shoots are used as leafy vegetables and the flowers also produce good quality honey which will prevent the effect of free radicals which causes cancer, buckwheat is rich in protein lysine, which is deficit in cereal crops, it has dense fibrous root system with deep tap roots which helps in improving soil aeration and to check soil erosion, buckwheat also helps in suppressing the weed growth during its vegetative and flowering stage as its leaves and stem release certain allelochemicals which results in decrease of nitrogen uptake of weeds thus reducing the entire biomass.

Keywords: Rutin, P "scavenger", free radicals, allelochemicals

Introduction

Buckwheat term is derived from two Anglo-saxon terms, boc (beech) and whoet (wheat) belonging to family Polygonaceae, in china buckwheat is used as a grain crop for over 1000 years, and is mainly cultivated in China, Bhutan, Canada, Japan, and high altitude regions like Himalayan planes which are also a richest hotspot of biodiversity, now a days the cultivation of buckwheat is widely done in north eastern states, Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, Darjeeling, Sikkim, Assam, Nagaland, Manipur and in some regions of south Indian states such as Karnataka and Tamil Nadu. In hilly areas buckwheat is used as a staple crop as cereals and pulses can't be grown, so to meet the demand of food supply, as an alternative buckwheat must be encouraged for cultivation as the monoculture cropping system, which mainly covers some cash crops should not continue and subsequent changes should be made to diversify the cropping pattern around the globe in a way that both human mankind and ecology should be sustained and also for economical balance in a way that under any natural disaster conditions huge losses will be incurred and will take a lot of time to recover from the impact, in such cases by crop diversification both time and economy can be managed, buckwheat not only helps in crop diversification but it also has its own diversification in various factors from seed to seed, it is a free growing crop which can be grown under limited resources such as low fertilizer requirement, it has good allelopathic response against weeds resulting in reducing the biomass of weeds grown in buckwheat plot, honey extracted from its flowers has a good demand, it has an active role in cultivation of honey bees thus enhancing farmers income and ecology, buckwheat honey has very numerous benefits such as higher antioxidants, rich in vitamins, helps in lowering blood pressure, it also acts as an important forage crop, cover crop, nurse crop, as the vegetative growth is attained In a very short period

it can be used for green mulching. It plays an important role in reducing weed density up to 80%, also buckwheat possesses a good C:N ratio of 3:4 which helps in immobilizing nitrogen during decomposition, it has a unique root system with dense fibrous root system and deep tap roots which leads to soil aeration and soil erosion control.

Buckwheat as an alternative for major food crops

Buckwheat is one of the world's first domesticated crop but in these days cultivation and production of buckwheat has been reduced drastically, out of 10,000 species we are cultivating only 12 species which are dominating across the globe this culture of monopoly of cultivating less number of crop species for more economic benefits is causing major imbalances in biodiversity, if we make our path towards diversification of cropping patterns we can not only make changes to our life style but also we can protect indigenous species such as buckwheat which possesses higher medicinal values such as gluten free grain containing 10% moisture content, 11.2% protein, 2.4% fat 10.7% fibre and minerals such as Fe, Zn and it also carries biological compounds such as protocatechuic acid and epicatechin gallate, buckwheat has higher rutin content than any other vegetable, fruit and grain, rutin is present in the form of quercetin-3-rutinoside with antioxidant and some physiological properties buckwheat grain carries orientine, vitexin, quercetin, isovitexin, isoorientin, and other components such as fagopyritols. buckwheat flavanoid are used in pharmaceutical industries such as cough relief and eliminating phlegm and also buckwheat contains good amounts of Cu which helps in preventing hypohemia, cardiovascular effects, used for preventing gall stones, celiac disease and few hormone dependent tumours, rutin has the unique ability of treating hypertension by lowering blood sugar.

Soil phosphorous enrichment by buckwheat roots

Buckwheat roots have a unique ability to enhance soil phosphorous content with its dynamic structure of deep tap root system and dense fibrous root system, the crop will attain its maximum vegetative growth in a very short period, at this stage the crop can be used for mulching after which the plant will get decayed by producing good amount of phosphorous which can be utilized by the succeeding crop on a condition that the plant must be included in topsoil only because buckwheat roots are not good at loosening subsoil hardpans by which we can also improve soil structure of the top soil, by improving water infiltration rate, microbial activity, tilth, organic matter, the roots will ooze out protons (H^+) which will lead to solubilize calcium-bound phosphorous in alkaline soils, along with the mobilization of phosphorous, it also has the ability to store inorganic phosphorous

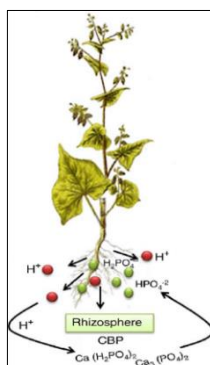


Fig 1: Rhizosphere

In the above figure we can observe that the buckwheat plant roots emitting H^+ protons which are resulting in solubilizing the calcium bound phosphorous (CBP) thus converting unusable form of phosphorous into usable form which can be uptaken by plants, this is the unique ability which can be observed only in buckwheat

Buckwheat as a weed suppressor

Buckwheat crop has a specific character that it can compete with the growth of weeds resulting to suppress weed growth during vegetative and flowering stage buckwheat exhibits weed suppression by decreasing the total biomass of the weeds both buckwheat plants and its residues can also be used against weed suppression, it can also be used as a cover crop by growing it prior to the cultivation of main plant until buckwheat attain flowering stage then it's plant can be used as a mulch for the successive crop, plant contains gallic acid which plays an important role in inhibition of dicotyledonous weed species, also cultivating of two crops with buckwheat shows better result than single crop in suppression of weed growth thus it is considered as "smart cover crop" buckwheat plant plays special role in allelopathy, as leaves and stem exhibit allelopathic effect when the crop is used as mulch purpose buckwheat compete the growth of weed roots thus oozing out allelochemicals resulting in the restriction of fungal pathogen activity in soil and under this process up taking of nitrogen is decreased resulting in the reduction of weed seed germination, root, shoot growth and seed set, different buckwheat species show different effects on reduction of weed growth such as *D. ciliaris*, *E. crus-galli* var. *crus-galli*, *P. oleracea*, *C. album* and *A. lividus*

Other important uses of buckwheat

Buckwheat is richer in Zn, Mn, Cu, the crop attracts beneficial insects such as hover flies (*Allograpta oblique*), predatory wasps, minute pirate bugs (*Orius spp*, *Anthocoris spp*), insidious flower bugs, tachinid flies (*Bombyliopsis abrupta*) and lady beetle (*Psyllobora, vigintiduopunctata*) these insects are predators also its quick growth and good plant height helps in weed suppression due to sunlight by growing this crop use of herbicides can be reduced, nectar of the flower contains special aroma this attracts honey bees the honey has unique trade value, sugar content of honey is low, but its medicinal properties are high, color of honey is dark purple to black, mainly *Apis mellifera* is used for collection of honey, the crop is grown to check soil erosion because of its root structure, organic matter and earthworm activity is good, the crop plays a major role in natural farming thus reducing the cost of cultivation, known as "smooth crop" for its easier agronomic practices.

Conclusion

Buckwheat cultivation needs attention because of its quick growing ability and the unique quality of solubilizing soil P content and allelopathic effect thus the ability to control weeds, grains have high nutraceutical value, by comprising all the above unique characters buckwheat should be considered as important crop and should value the same as major cultivating crops thus increasing the focus on breeding programmes for the development of better performing varieties which are climate resilient and also can be cultivated across the globe, as they are restricted for high altitude regions only.

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