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RICEBEAN: POTENTIAL UNDERUTILIZED DUAL-PURPOSE LEGUME

Pramod M.[1], Hardev Ram[1*], Rakesh Kumar[1] and Rajesh Kumar Meena[1]

[1] ICAR-NDRI, Agronomy Section, Karnal, Haryana 132001

*Corresponding author email: hardev.ram@icar.gov.in

ABSTRACT

Ricebean (Vigna umbellate) is an underutilized, neglected, and unexploited multipurpose legume crop that is grown for grain, fodder, green manure, cover crop, and intercrop in maize and sorghum for better yield. It is grown in the north-eastern part and hilly tracts of eastern and western Ghats in India. Rice bean possesses excellent potential to meet the demand for pulses to maintain food and nutritional security. It is also resistant to pests and disease, tolerance to various abiotic stresses, short duration and fit for different cropping systems make it less vulnerable to changing climatic scenarios. Based on the benefits and qualities of rice bean, the crop may play a big role in achieving nutritional and livelihood security.

INTRODUCTION

Pulses are the second most important consumed food crops globally; it is estimated that pulses contain 20-25% protein by weight and provide around 33% low-cost dietary protein to humans. Apart from that, being a legume crop, rice beans can fix the atmospheric nitrogen by symbiosis with Rhizobium bacteria and help maintain soil fertility by adding organic matter and preventing soil erosion. India is the leading producer (25% global production) and consumer (27% world consumption) of pulses. Major pulses grown in India are chickpea, moong bean, and black gram, but there is still a wide gap between demand and supply of pulses due to the growing human population. Currently, pulse production is about 24 metric tonnes from 30 million hectares and imports 2.23 metric tonnes. Productivity of pulses is very low due to cultivation at poor marginal and exhausted soils, climate change, genetic and agronomic factors and government policies. These issues can be addressed by growing improved variety, adopting modern techniques, and expanding underutilized legume crops.

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ORIGIN AND PLANT TYPES

Rice bean is also known as the oriental bean, red bean, climbing and mountain bean. It derived from the wild form of Vigna *umbellata var. gracilis*. This crop is grown in Southern China, northern Vietnam, Laos, Thailand, Burma, and It is native to South, and Southeast Asia believed to be domesticated in Indo-china. Rice bean is a climbing and bush type annual or perennial legume with trifoliate leaves grown to 3m

in height. The plant of rice bean have small leaves, photoperiod insensitivity, indeterminate type growth habits, branched stem, self pollinated, produces bisexual flowers with extensive taproot system up to 1.5 m deep. The seeds are oblong, colored with a smooth surface with hypogeal germination.

Figure 1. A view of standing rice bean crop in the field

POTENTIAL USES OF RICE BEAN

Rice bean has 14 to 26% of the protein in the grain, whose bioavailability is quite high compared to other legumes. Ricebean is a low-fat food that carries 1.92 to 3.42% total fat and provides sizeable amounts of essential minerals such as Ca, P, Mg, K, Fe, Zn, Cu and Mn. The grains are generally used to prepare dal (boiled soup) and curry, whereas younger leaves and green pods are used as vegetables. It is excellent fodder for livestock because of its high nutritive value and more palatability (Table 1).

Table 1 Nutritive value of fodder rice bean

Parameters	Value (%) on dry matter basis
Dry matter	21.4
Crude protein	19.0
Crude fibre	30.8
NDF	59.7
ADF	38.7
Ether extract	1.8
Ash	10.4

Source: Chaudhauri *et al.*, (1981)

CULTIVATION PRACTICES

CLIMATE REQUIREMENT

Ricebean is a warm-season legume grown in humid subtropical to warm and cold temperate climates. It grows well between 700 - 1300 m above mean sea level. It performs well in average temperatures ranging between 18 to 30^0C but can tolerate temperatures from10 to 40^0C but doesn't withstand frost. It can grow well rainfall ranges from 1000 to 1500 mm $year^{-1}$, at lateral stages of growth,

it can tolerate waterlogged conditions. Rice bean is a short-day plant that requires a short day length to produce seeds.

LAND PREPARATION AND SOIL TYPE

It can be grown in many soils, including exhausted drought-prone and degraded soils but perform better in loamy soils; the optimum pH for better growth is 6.8 to 7.5. It is also grown in acidic soil, but it is susceptible to alkaline soils, avoid cultivation in sandy soils due to infection of root nematodes. In acid soils, application of lime @ 0.4–0.6 t ha^{-1} for root nodule formation and better seed yield. One ploughing with MB plough followed by two harrowing and levelled the field by planking and weed-free environment is necessary for proper germination and faster initial growth.

Table 2 Promising Grain and fodder varieties

Grain varieties			
Variety	*Developed by*	*Average yield (q/ha)*	*Recommended zone*
RBL-1	PAU, Ludhiana	15.4	Punjab and Northern states
RBL-6	PAU, Ludhiana	15	Northern plains
PRR-1	GBPAUAT, Ranichauri	16	Uttarakhand hills
PRR-1	GBPAUAT, Ranichauri	15	Northwest hills
BRS-1	ICAR-NBPGR, Bhowali	17	Northwest hills
RBL-35 & 50	PAU, Ludhiana	15	Northern plains
Fodder Varieties			
Variety	*Developed by*	*Average yield (q/ha)*	*Recommended zone*
Bidhan 1&2	BCKV, WB	30-35	East and northeast India
Konkan 1	Dapoli, Maharashtra	22.0	Konkan
Suravi	Trisuru, Kerala	22.0	Kerala
Bidhan 3	BCKV, WB	35	east and northeast

Source: Planta (2019)

SOWING TIME AND SEED RATE

It can be sown from March to April. For fodder purposes, the general recommended seed rate is 30 to 35 kg ha^{-1} and grains 20 to 25 kg ha^{-1}, respectively. It can be sown 30 cm apart in rows with seed drill or behind a desi plough. Soaking of seeds 12 to 15 hours before sowing helps in good germination.

CROPPING SYSTEM

Ricebean is a legume crop grown as an intercrop with cereals (maize and sorghum) in both grain and fodder crops. Intercropping with cereals fodder gives better quality fodder for the animal. Major rice bean-based cropping systems is Rice-Ricebean (annual), rice-wheat-ricebean, jute-ricebean-maize. These systems are practised in the north-eastern parts of India.

NUTRIENT MANAGEMENT

Rice bean is normally grown in poor marginal and exhausted soils with low inputs. Ricebean can also be able to fix atmospheric nitrogen. For better productivity and quality, fodder crops can apply farmyard manure 5 t ha^{-1} 15 to 20 days before sowing and basal application of 20 and 50-60 kg N and P_20_5 ha^{-1}, respectively.

WATER MANAGEMENT

There is no need for irrigation in the monsoon period, but provide one or two irrigation if the monsoon fails. It can also be successfully grown in residual soil moisture after paddy harvesting.

WEED MANAGEMENT

Being a legume crop ricebean suppresses the weeds by smothering effect. Application of Pendimethalin as a pre-emergence herbicide @ 1 kg a.i ha^{-1} could successfully manage the initial flush of weeds. In the early stages of growth, one hand weeding at 25-30 days after sowing is essential for better yield.

PEST AND DISEASE MANAGEMENT

Rice bean is resistant to yellow vein mosaic virus and storage pest; bruchid beetles. Powdery mildew is a major disease that can be prevented by spraying Dithane M-45 @ 0.2%. Although insects are not a major problem, spray of Dimethoate @ 0.03% reduces insect infestation if their attack occurs. Sanitation of field, proper drainage and use of healthy seed avoid the infestation of disease and pests.

HARVESTING

The crop gets ready for harvesting at 50% flowering for fodder purposes. The grain can be harvested when 75% of pods turn brown, and 2 to 3 pickings may be taken.

YIELD

A good crop of Ricebean may give green fodder yield may obtain about 175-350 q ha^{-1} from summer crop and 200-350 q ha^{-1} from *Kharif* crop. Good management practices give around 30 to 35 t ha^{-1} green fodder. The grain crops of Ricebean obtain about 15-15 q ha^{-1} with good management practices.

CONCLUSION

Ricebean is an underutilized multipurpose legume with a huge potential to fulfil the demand for pulses and fodder at a cheaper cost. It is also resistant to pests and disease, tolerance to various abiotic stresses, short duration and fit for different cropping systems make it less vulnerable to changing climatic scenarios. Based on the benefits and qualities of rice beans, the crop may play a big role in achieving nutritional and livelihood security.

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