

***Lathyrus sativus* in rainfed multiple cropping systems in West Bengal, India – a review**

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Background information:

Grasspea (*Lathyrus sativus* L.) is grown as a pulse crop in India, in the state of West Bengal it is grown particularly in rainfed rice-fallows in the winter season on about 20 000 ha. It is grown widely on the Gangetic plains comprising the states of Bihar, Madhya Pradesh, Maharashtra, Uttar Pradesh (East), West Bengal, Assam and Tripura in India. In Nepal, Bangladesh, Iran, the Middle East, South America, Europe, North and South America and Australia grasspea is also grown, where there is a winter season. In southern Bangladesh, grasspea (known in Bengali as *khesari*) is grown in deep-water paddy-fields, in marshy/muddy conditions as a *paira* (no-tillage relay) crop, after the receding of flood waters in the early weeks of November. Similarly, in neighbouring West Bengal, India, the *paira* system is used in the medium/low lying rainfed rice-areas. However, in order to improve yields, research is necessary. The mean seed yield in the state is about 1000 kg/ha, roughly double the mean over the whole of India. Experimental yields in West Bengal show 1100-1400 kg/ha are possible.

Geographical position and climatic conditions of West Bengal:

West Bengal is one of the eastern states of India (situated between 21°31'N to 27°14'N and 85°51'E to 89°00'E longitude). It is surrounded by the Bay of Bengal in the south, Bangladesh in the east, Nepal and Bhutan in the north and Bihar and Orissa in the west. It has 18 districts, supports 68.1 million population, with a total area of 88,752 km². West Bengal has a range of different climatic conditions, land situations and soil types, along with high moisture/water potential, due to heavy rainfall over a long period (April to October).

There are three distinct seasons in the southern plains, summer (pre-*kharif*), rainy (*kharif*) and winter (*rabi*), hence many types of seasonal crops can be grown. In the rainy season, of course, transplanted rice (*Oryza sativa* L.) is grown without irrigation but with natural

precipitation and thereafter grasspea is grown as *paira* (no-tillage relay) crop.

(i) *Summer*. In the summer (April to July) there is 350 to 500 mm of rainfall, very high temperatures (38 to 40°C) and high humidity. During summer jute, *mesta*, *aus* rice (direct seeded rice), sesame, mungbean, cowpea, maize etc. are the main crops.

(ii) *Rainy season*. In the rainy season (July to November), there is high rainfall (900 to 1100 mm), high temperatures (30 to 37°C) and very high humidity (95 to 98%). In medium or low lying areas transplanted rice is grown. In high land maize, blackgram, cowpea, rice-bean, sesame etc. are grown.

(iii) *Winter*. Winter is the dry season without rainfall, but with bright sunshine, lower temperatures (minimum 8 to 16°C) and low humidity. During this period, under rainfed conditions, mustard, grasspea, sunnhemp (for seed), lentil, linseed, oat, pea, barley, gram, niger etc. are grown. Research on different aspects of grasspea have been done in this season, such as pulse production, fodder production, green manuring crop, weed control, soil fertility maintenance, moisture conservation, fertiliser response, low waste land utilization and ultimately for rainfed rice-based 3-crop systems in West Bengal. In India, of course, much work has been done⁽¹⁴⁾ and some new varieties have been developed among which Nirmal 1, Nirmal 2, Pusa 24 are recommended for cultivation because of low BOAA (β -N-oxalylamino alanine or ODAP) content (less than 0.2%). Only the research work conducted in West Bengal is reviewed here.

Research Review:

The research carried out with grasspea in West Bengal has been mostly by the scientists of Bidhan Chandra Agricultural University (BCKV), situated in the eastern part (Nadia district) of the State.

Pulse production. Grasspea is generally grown as *dal* (i.e. pulse crop) in India particularly in medium/low lying rice fields, under rainfed conditions. Research work has been intensified recently in order to increase production of grasspea, under different situations and conditions. It has been observed that grasspea as a *paira* crop can produce high seed and green fodder yields^(1,3).

Fodder production. In the multiple cropping programmes under rainfed conditions, grasspea gave good yields of green fodder ranging from 15 000 to 25 000 kg ha⁻¹, when harvested at flowering⁽¹¹⁾. If the preceding rice-straw height was greater (about 30 cm), the green fodder was also increased. Conversely, if the preceding rice-straw was cut at soil level, the seed yield of grasspea was higher⁽⁵⁾.

Green manuring. Grasspea is grown in the winter season under rainfed conditions and due to low temperatures it does not decompose well. However, if it is grown in irrigated areas, it can be utilised as a green manuring crop by the end of February, just before transplanting of summer rice (*boro*) (Chatterjee, pers. comm.).

Weed control and weed utilisation in grasspea crops. Grasspea as a *paira* crop after rainy season rice, under rainfed conditions, heavily suppressed weeds (eg. *Cyperus rotundus*, *Cyrodon dactylon*, *Melilotus alba/indica*, *Chenopodium album*, *Vicia hirsuta*) and the grasspea dominated the weeds and grew well⁽⁷⁾. At an earlier stage, grasspea is supported by the weeds present in the field (there are more weeds due to no-tillage cultivation).

It has also been observed that un-weeded *paira* grasspea gave higher seed yield than that of a weeded control, indicating that weeds in *paira* grasspea increased growth and yields under these conditions⁽⁷⁾.

Maintenance of soil fertility. Grasspea, as a *paira* crop under rainfed multiple cropping systems, had some effect on improving soil fertility, particularly in terms of organic matter, total nitrogen and available phosphate⁽²⁾. Higher yields of mungbean and *mesta* after grasspea reflected higher soil fertility in the rainfed 3-crop systems⁽¹³⁾.

Moisture conservation. In the dry (winter) season, a *paira* grasspea crop in a rainfed 3-crop system, improved the soil moisture during growth thus assisting germination of the next crop⁽⁹⁾.

Response to fertiliser. A *paira* grasspea crop after rainy season transplanted rice, did not respond to phosphate at different levels or NPK-fertiliser in combination⁽⁵⁾.

Low wasteland utilisation. Some areas of the state cannot be utilised for growing crops during the rainy season because of heavy water stagnation, due to the high rainfall. These lands are commonly weedy. After receding water during October/November, the low lying waste lands can be utilised in winter by broadcasting seeds @ 60 kg ha⁻¹ of grasspea, under no-tillage, muddy/marshy and rainfed conditions⁽¹⁰⁾.

Preceding rice-straw height. Preceding rice-straw height at 15 cm above the ground, was beneficial for production of both seeds and fodder of *paira* grasspea under rainfed condition in rice-fallows⁽¹²⁾.

Tillage and seed production. Grasspea as a *paira* crop after rainy season rice, showed the best performance for seed yields, compared to two- or

four-tillage operations, though it required 45 days after flowering for good seed set⁽⁴⁾.

Rainfed rice-based 3-crop system. Rainfed transplanted rice is the main crop in the rainy season, because of high rainfall and water stagnation in medium or low lying areas of the State. Jute and *aus* rice (direct seeded) are the main crops in the summer season, because of moderate but frequent rainfall. Winter is the dry (mostly without rainfall) season. Grasspea is grown as *paira* crop, broadcasting seeds over the matured rainy season transplanted rice, in muddy or marshy conditions. The rice crop is harvested the next day, leaving the grasspea seeds to germinate and grow utilising the residual soil moisture. Thus, under rainfed conditions in West Bengal, "jute-rice-*paira* grasspea" can be included as a 3-crop system^(6,8).

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