

High-yielding and multiple stress resistance field pea varieties suitable for cultivation in north-eastern plains of India

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Field pea (Pisum sativum L.) is a vital pulse crop in India, particularly in the rabi season, serving as an essential protein source. This article focuses on the development of two new field pea varieties, Shikhar (IPFD 19-1) and Arpan (IPFD 19-3), developed by ICAR-IIPR specifically tailored for the North Eastern Plain Zone (NEPZ). These varieties exhibit high yield potential, disease resistance, and suitability for both irrigated and rainfed conditions. Both varieties exhibit resistance to powdery mildew and ascochyta blight, with moderate resistance to rust, offering improved grain quality. These high-yielding, resilient varieties have the potential to significantly contribute to field pea production in the NEPZ, supporting increased productivity in both irrigated and rainfed environments.

Keywords: Field pea, High yielding, North-eastern

FIELD pea (*Pisum sativum* L.) is one of the important *rabi* season pulse crops next to chickpea and lentil in India. It is being consumed in different forms such as soup, chat, chhola, dal, stew, snacks, vegetables and flour. Besides, its flour is also used in food based industries as a thickening agent. The seeds are admirable source of proteins (21.2-32.9%), carbohydrates (56-74%), vitamins, minerals and fibres. It is acknowledged as one of the cheapest sources of easily digestible protein for human and livestock owing to the lack of major anti-nutritional elements. The seed coat and cotyledon are dietary fibre rich fragment of seed. It is also acknowledged as suitable candidate crop for crop rotation, green manures, and cover crops, by the virtue of inherent fast growing ability and soil nutrient enrichment through atmospheric nitrogen fixation.

In India, this crop covers about 0.64 million hectares area with 0.88 million tonnes production. The highest area and production were recorded 1.06 mha and 1.01 mt,

respectively, during 2016-17 and decreased in subsequent years. The area and production has been decreased dramatically around 40% and 13%, respectively, as compared to 2016-17. This crop is mainly cultivated in northern and central parts of the country. The major field pea growing states are Uttar Pradesh, Madhya Pradesh, Jharkhand, Bihar, Assam and Maharashtra. During recent past, several field pea varieties i.e., IPFD 10-12 (Green seeded), IPFD 11-5, IPFD 12-2 and IPFD 2014-2 suitable for central parts have been developed. In the case of North Eastern Plain Zone (NEPZ) comprising states of Bihar, Jharkhand, Assam, West Bengal and eastern parts of Uttar Pradesh, very limited options are available among farmer for varietal selection due to dearth of varieties. In white seed category, VL-42 variety was the only choice for the growers released in 2007. During last 15 years, not a single variety was developed in this category, however, IPF 16-13 (Harit), a green seeded variety was developed by ICAR-IIPR, Kanpur. Therefore, being a national institute

in the field of pulses research and development ICAR-IIPR, Kanpur is having more responsibility to develop suitable varieties of pulse crops for different agro-climatic conditions. The major focus of breeding programme was to breed high yielding and disease resistant semi-leafless or leafy dwarf type field pea variety for irrigated and rainfed areas. Consequently, concerted efforts have been made and two high-yielding field pea varieties i.e. Shikhar (IPFD 19-1) and Arpan (IPFD 19-3) have been developed which are suitable for cultivation in NEPZ.

SHIKHAR (IPFD 19-1) is a dwarf and semi-leafless type field pea variety having white flower colour and creamish white colour seeds derived from the filial generations of cross synthesized in 2010-11 between field pea and vegetable type genotypes 'IPF 5-19 and 'MDP 2, respectively. **ARPAN (IPFD 19-3)** is another dwarf and leafy type field pea variety with white flower, round and creamish white seed. It is derived from the cross of 'IPFD 1-10' and 'IPFD 10-13'

utilized as parents in 2010-2011. The subsequent generations of both the crosses were further advanced by selection of superior plants/progenies during 2011 to 2017. The stabilized lines were evaluated in preliminary yield trials (PYT) and station trials during *rabi* 2017-18 and 2018-19, respectively, for grain yield and other yield attributes. All the selection and appraisal work was performed at ICAR-Indian Institute of Pulses Research, Kanpur. Considering the performance of IPFD 19-1 and IPFD 19-3 in station trials, both were entered in initial varietal trials (IVT) of the All India Coordinated testing programme of AICRP on MULLaRP during 2019-20. These varieties constantly out-performed the national, regional and local check varieties under National testing during 2019-20 to 2021-22. These promising lines have already accomplished three years of testing and exhibited stable grain yield and other traits in North Eastern Plain Zone (NEPZ) of India (Table 1).

The variety **SHIKHAR (IPFD 19-1)** has the average grain yield of 1917 Kg/ha in NEPZ with potential grain yield of 27 q/ha. It has portrayed a yield advantage of 24.72% and 28.83% over the best check variety SKNP 04-9 and HFP-4 in NEPZ, respectively. Additionally, it has demonstrated 44.14% yield superiority over the landmark variety HUDP-15 in the NEPZ. It is a dwarf and leaflet less type in growth habit with average plant stature of 74 cm. It has white flower, green glabrous stipules, spherical and creamish white smooth seed. It takes 120-125 days to mature, hence, comes under medium maturity groups and has medium bold seed size (18.0 g). The variety **ARAPN (IPFD 19-3)** also gave average yield of 1767 Kg/ha in NEPZ with yield potential of 26 q/ha. It has demonstrated a yield benefit of 14.96% and 18.75% over the best check variety SKNP-04-09 and HFP-4 in NEPZ, respectively. Moreover, it has also depicted 32.86% yield supremacy over the ruling check variety HUDP-15 in the NEPZ. It has white flower, green glabrous leaves, spherical and



Field view and seeds of Shikhar and Arpan

creamish white smooth seed. It has medium maturity duration with average of 122 days and medium bold seeds (18.55 g).

The field pea crop performance is adversely affected by fungal diseases like powdery mildew, rust and ascochyta blight in terms of grain quality and grain yield. Therefore, dedicated efforts were made to

incorporate the resistance/tolerance against the above mentioned biotic stresses which will certainly help in realization of actual yield potential of variety. Shikhar and Arpan varieties demonstrated resistance reaction to powdery mildew as well as ascochyta blight and moderate resistance reaction to rust (Table 2). Furthermore, both varieties were

Table 1. Performance of Shikhar (IPFD 19-1) and Arpan (IPFD 19-3) varieties under coordinated varietal trials conducted during 2019/20 to 2021/22 in north eastern plains of India

Mean yield (kg/ha) in zone/region	Year of testing	No. of locations	Shikhar (IPFD 19-1)	Arpan (IPFD 19-3)	SKNP 04-9 (Check 1)	HFP 4 (Check 2)	HUDP 15 (Check 3)
North eastern plain zone	2019-20	05	2225	1872	1516	1443	1315
	2020-21	05	1696	1740	1469	1490	1484
	2021-22	05	1829	1690	1625	1532	1190
	Weighted Mean	15	1917	1767	1537	1488	1330
Percentage increase over the checks varieties	Shikhar				(+)24.72	(+)28.83	(+)44.14
	Arpan				(+)14.96	(+)18.75	(+)32.86

Table 2. Reaction to major biotic and abiotic stresses in coordinated varietal trials in NEPZ during 2019-20 to 2021-22

Disease	Shikhar (IPFD 19-1)	Arpan (IPFD 19-3)	SKNP 04-09 Check-I	HFP 4 Check II	HUDP-15 Check-III
Powdery mildew	1.3	1.5	1.6	1.8	2.2
Rust	5.0	4.0	5.0	5.0	6.0
Ascochyta blight	1.7	1.5	2.0	2.3	1.8
Pod borer (% Pod damage)	7.93	6.64	9.36	6.46	9.06
Aphid (Aphids/10 cm twig)	1.83	3.73	3.16	3.10	4.20
Leaf miner (% leaf damage)	5.96	4.69	4.78	7.50	6.56

less preferred by prominent insect-pests like pod borer, aphid and leaf miner as compared to best check variety (Table 2). In case of quality, these are good source of protein which ranged between 20-24%. Most interestingly, the shikhar variety being a semi-leaflet less (tendrill type) have better standing ability through inter-locking of plants in a population till full maturity. The better standing ability improves penetration of sun rays to lower portion of the plant and proper aeration, which consequently reduce the chances of disease infestation as compared to other varieties with dense foliage. Similarly, the network of interlocked tendrils above crop canopy is likely to assist in reducing

damage due to birds. Hence, both high yielding varieties coupled with resistance/tolerance to prevailing biotic and abiotic stresses would be best replacement for ruling variety HUDP-15 and play important role in increasing production and productivity of field pea in north eastern plains of India in irrigated as well as rainfed ecologies.

SUMMARY

The recently released varieties namely Shikhar and Arpan are resistant to powdery mildew, ascochyta blight and tolerant to rust, hence, these would be best suitable to avoid yield losses in powdery mildew, ascochyta blight and rust prone ecology of north eastern plains

of India. In addition, these varieties are least preferred by prevailing insect pest like pod borer, aphid and leaf miner. Most interestingly, both are good source of protein which ranged between 20-24%. Hence, these elite varieties with high yield potential, resistance/tolerance to prevailing biotic and abiotic stresses and good protein content would be best suitable alternatives for replacement of existing old varieties and play important role in increasing production and productivity of field pea in north eastern plains of India to ensure nutritional security.

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