

Raising productivity of pulses in diverse agro-ecologies of North East Hill region of India - A case study

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ABSTRACT

Time-bound promotion of pulses in strategically located northeast region of India needs a focus on developing and evaluating high yielding varieties of pulses with resistance to major biotic stresses for normal as well as late sown conditions. Suitability of these varieties calls for tactical release, production, distribution and adoption of varieties of pulses specific to rainfed areas amalgamated with improved agronomy. A two-years study with the aim of promoting pulses in NEH region during 2014-16 revealed that across 4 locations in this region, higher crop performance in terms of grain yield and its attributes was with chickpea 'PUSA 372' (1386 kg/ha) followed by 'IPC 97-67' (1365 kg/ha). Superior performance of lentil 'DPL 62' (1197 kg/ha) was also realized across 7 locations in NEH region which necessitated the varietal promotion and its popularization there. Similarly, superior performance of fieldpea 'AMAN' (1290 kg/ha) was observed across 5 locations (Mizoram, Sikkim, Arunachal Pradesh, Manipur and Meghalaya) while, 'TRCP 9' was better adapted to Assam and Tripura conditions. Fababean varieties were successfully evaluated at Imphal, Manipur which indicated superiority of its genotype 'Patna 6' (891 kg/ha) over the rest of the varieties due to higher 100 seed weight (23.6 g). This genotype also performed better over two popular varieties (*viz.*, 'Swarna Suraksha' and 'Swarna Gaurav'). Evaluation of mungbean varieties sown during pre-kharif indicated improved performance of 'HUM 12' and 'IPM 2-14' in at least three locations with the highest average productivity of 1072 and 1057 kg/ha, respectively across four locations. Seed production in pulses to the tune of 1890 kg fieldpea, 3390 kg lentil, 28000 kg rajmash, 840 kg mungbean & 1100 kg urdbean (a total of 35220 kg out of which 3120 kg was breeder seed and the rest were truthfully levelled) were produced at 3 NEH locations *viz.*, Lembucherra (Tripura), Shillongani (Assam) and Imphal (Manipur) during 2015-16. It is inferred from the study that these suitable varieties of pulses, when popularized and adopted, could go a long way in raising the production and productivity of pulses in these constraint areas of the country.

Key words: Agro-ecologies, North East Hill region, Productivity, Pulses, Rainfed region, Rice fallow

North East Hill (hitherto called NEH) region of India namely Assam, Meghalaya, Arunachal Pradesh, Manipur, Mizoram, Nagaland, Tripura and Sikkim were unique in their physiographic location, climatic condition, suitability of crops, food habits of people and market access (Anonymous 2015, 2016). Despite great scope and better opportunities for pulses production in these states, the

growth rate is low due to many intricate and interrelated factors right from soil/climate related constraints to technological and extension oriented problems. Shrinkage in land holding, growing population pressure, increasing food/pulse demand and poor soil health are the key constraints. Besides these, poor soil health, the key component in production environment, is mainly attributed to soil acidity, aluminum toxicity, undulated topography and sloppy terrains (Anonymous 2016; Bhadana *et al.* 2013).

So far acreage and production of pulses in the NEH states are concerned, pulses are grown in around 257 thousand hectares with annual production and productivity of 228 thousand tonnes and 886 kg/ha, respectively (Anonymous 2016). Assam is the major state where pulses occupy around 150 thousand hectares with an annual production of around 104 thousand tonnes. Peas and lentil are mainly grown during winter while, urdbean and pigeonpea are important crops during rainy season. Nagaland is the second important NEH state for pulses where rajmash, peas, lentil and chickpea are grown. These states are followed by Manipur (third state of NEH region in terms of area) where peas, rice bean, urdbean, mungbean, chickpea and lathyrus are grown. Besides these 3 states, the others (states) occupy a meager area (a few thousand hectares) so far acreage of pulses are concerned. There is great scope for cultivation of pulses in these region despite inherent physical (soil, physiographic related) and other climatic/socioeconomic constraints. The three major steps taken appropriately towards promoting pulses in these region included (i) assessing the suitability of different pulse crops in a particular agro-ecoregion, (ii) evaluating a suitable variety and other agro-technologies for it and (iii) stepping up of production through pulses seed multiplication and its distribution. Keeping these objectives in view, a new and fresh time bound initiative was undertaken by ICAR-Indian Institute of Pulses Research, Kanpur in association with AICRPs on Chickpea, Pigeonpea, MULLaRP, Arid legumes and the NEH institutes to promote the pulses there (in NEH region) during 2014-16.

MATERIALS AND METHODS

Strategic planning and concrete action plans and initiatives on the above three important steps for promotion of pulses in NEH region was undertaken by ICAR-Indian Institute of Pulses Research, Kanpur from 2014-15 to 2015-16 (2 consecutive years). In addition to ICAR-IIPR, the

networking projects working at the national level viz., All India Coordinated Improvement project (AICRP) on chickpea, pigeonpea and MULLaRP (mungbean, urdbean, lentil, Lathyrus, rajmash and peas) and Arid legumes (mothbean, cowpea, horsegram and cluster bean) were involved in the above initiative to promote pulses in NEH region on a time scale (rainy season, winter season and spring season during these years). In addition to these, the whole gamut of national network systems of AICRP and NARS were involved to execute action oriented programmes by directly and indirectly contributing popular varieties for evaluation and seed multiplication in NEH region.

On climatic condition at NEH region, the weather parameters during the growth period of pulses especially at Manipur and adjoining region indicated variable temperature pattern and deficit moisture regime (especially in the winter season of 2015-16) during crop growth thereby affecting both crop growth and development in pulses. However, the crop was grown successively in presence of long dry spells in winter following supplemental life saving irrigations. Although normal yields were obtained in chickpea, lentil and fieldpea; yet other relatively long duration pulses (pigeonpea) suffered due to lack of soil moisture at the later critical stages of the crops. In Pasighat condition in Arunachal Pradesh, November sown pulses faced low moisture condition in soil even up to January, 2016 requiring life saving irrigation. Further, rainfall of >70 mm during February and March, 2016 created a favourable condition for excessive vegetative growth in lieu of flowering/pod formation. Even during April, May and June 2016 (for pre-monsoon mungbean), the state received ample rainfall of 50, 28 and 48 cm, respectively resulting in severe incidence of powdery mildew in pulses especially in fieldpeas and low yield realization in mungbean. In nutshell, during 2014-16, the climate was more or less similar between the years/same seasons.

After primary assessment of pulses crop(s) suitable for the agro-ecoregion (cultivation and popularity of the pulses in a particular region), two pronged strategies were adapted to up-scale production of pulses in constrained areas of eight North East Hill states of India. Here, steps were taken to formulate a technical programme to assess the performance of these selected pulses varieties in these regions. To begin with, assessment of pulses in multi-locations under this region was carried out during 2014-16. Popular varieties of winter season pulses viz., chickpea, peas and lentil were indentured from the breeders and given to 8 centres namely, Basar (Arunachal Pradesh), ICAR centre, Imphal (Manipur), Kolasib (Mizoram), Medziphema (Nagaland), Tadong (Gangtok), Central Agricultural University (CAU), Imphal (Manipur), Lembucherra (Tripura) and Shillongani (Navgaon, Assam). The test varieties of chickpea (JG 11, JG 16, DCP 92-3, Shubhra, JG 14, KWR 108, IPC 97-67, KPG 59, Rajas and BG 372), fieldpea (Adarsh,

Aman, Vikas, Prakash, Rachna, Azad, Arkel, TRCP8, TRCP 9, IPF 6-3, VL 42, HUDP 15) and lentil (IPL 316, IPL 406, DPL 62, DPL 15, IPL 81 and PL 4) along with six varieties of fababean were included keeping in view of the fact that these varieties had been developed in close proximity (mostly from Northern Hill Zone, North Eastern and North Western Plain Zones) to NEH region. Besides these, seed multiplication programme was also undertaken in respect of important winter season pulses viz., chickpea, fieldpea, lentil and rajmash (at the locations viz., Shillongani in Assam, Lembucherra in Tripura and CAU, Imphal in Manipur). Improved agro-technologies adopted for the region (including package of practices) were followed in these crops to assess the optimum performance of these pulses/varieties under NEH region. Observations on grain yield, yield traits (pods/plant, seeds/plant and 100-seed weight), growth attributes (plant height and biomass weight) and phenological characters (days to 50% flowering and maturity) were taken meticulously for all the crops and seasons for data analysis, interpretation and promotion/popularization of pulses. Besides these, seed production details were recorded for further use/distribution.

RESULTS AND DISCUSSION

Successful amalgamation of suitable varieties and appropriate agronomic management in presence of physical (abiotic) and biotic stresses is the key to optimum performance of agricultural crops including pulses and their performance stability (yield formation in pulses) in any agro-ecoregion (including NEH region of India, Fig. 1). This could certainly influence the total output and distribution of pulses in the country as a whole and the NEH region in particular.

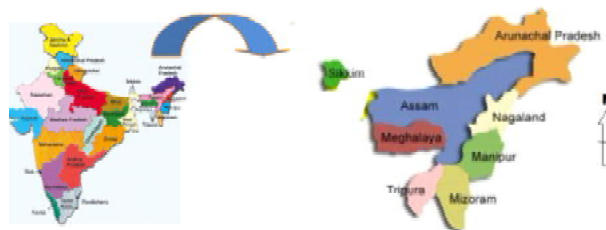


Fig. 1. The North Eastern Region of India

Promotion of chickpea in NEH region: Varietal evaluation of the selected pulses at different locations of NEH region indicated that potential of some of these varieties did exist as these performed better in certain region. Among the varieties of chickpea evaluated for realization of their yield potential during *rabi* season (winter) after harvesting of rice indicated higher yield realization in chickpea PUSA 372 (1386 kg/ha) followed by IPC 97-67 (1365 kg/ha) over other cultivars (Table 1). This was observed across 4 locations in NEH region viz., Shillongani in Assam, Lamphelpat in Manipur, Lembucherra in Tripura and Kolasib in Mizoram. Similar was the trend on other growth and yield attributes

(Table 2). Therefore, chickpea cultivar IPC 97-67 and PUSA 372 could be promoted and popularized at NEH region for realization of higher grain yield.

Promotion of lentil in NEH region: Similarly, varietal evaluation in lentil based on grain yield (Table 3) realized at NEH regions indicated superior performance of DPL 62 (1197 kg/ha) followed by IPL 406, Tripura Lentil Sel. 1 and IPL 316 with mean yields of 1041, 1002 and 1000 kg/ha, respectively over the rest of cultivars. This was observed across 7 locations taken in NEH region (Table 3). Obviously, the yield levels of these were more than 1 tonne/ha. Despite the fact that there was relatively low yield and consequently poor growth performance in production of pulses in NEH region comparing to the potential and actual yields under best management practices (BMPs), there existed a great scope for further boost in productivity of these pulses if popularized/adopted in these regions (Choudhary *et al.* 2012; Anonymous 2016). The hindrances in expansion of area & production in pulses mainly included shrinkage in land holding, growing population pressure, increasing food/pulse demand and poor soil health (mainly acidic soils), yet

there exists a vast potential for growing these crops under existing diverse conditions of NEH States (Anonymous 2015; Bhadana *et al.* 2013). Simpler agro-technique such as liming at the rate of 0.2-0.4 t/ha along with half of the recommended fertilizers could raise the potential to double the productivity especially for (oilseeds and) pulses in the acid soil regions of the country (Bhadana *et al.* 2013).

Thus, amongst lentil varieties, DPL 62 (requiring around 70 days to 50% flowering) showed its superiority over the rest of the varieties evaluated which was mainly attributed to relatively higher number of pods/plant and cluster/plant. Similar trend was observed in other growth attributes (Table 4). One important observation recorded in this case related to how relatively lodging susceptibility of DPL 62 (7.0) had been compensated by the lowest pod bearing node (16.7th node) at Lembucherra, Tripura (data not given). Therefore, lentil popular cultivar DPL 62 (along with other popular varieties with similar yield levels like, IPL 406, Tripura Lentil Sel. 1 and IPL 316) could be promoted and popularized at NEH region for higher grain yield realization (Table 4).

Table 1. Grain yield (kg/ha) realized in chickpea varieties across diverse NEH locations

Variety	ICAR-NEH, Kolasib, Mizoram	ICAR-NEH, Lamphelpat, Manipur	ICAR-NEH, Lembucherra, Tripura	AAU, Shillongani, Assam	Mean
IPC 97-67	1472	1257	1382	1349	1365
KWR 108	1337	764	1255	1044	1100
KPG 59	1113	1392	1288	1256	1262
Subhra	1128	1413	1199	1456	1299
DCP 92-3	1115	973	1147	1572	1202
JG 11	1063	709	1633	1105	1128
JG 16	1237	1275	1070	1615	1299
JAKI 9218	1118	876	850	1064	977
JSC 55	1253	908	1444	1298	1226
JSC 56	1387	1052	941	1206	1147
PUSA 372	1063	1765	1042	1673	1386
RAJAS	1407	895	1175	1093	1143
JG 14	1250	1422	965	1079	1179
PANT G186	1433	1188	992	1367	1245
C.D.(0.05)	239	406	155	177	330

Table 2. Yield attributes and other traits in chickpea cultivars at representative locations in NEH Region*

Variety	Kolasib, Mizoram		Lamphelpat, Manipur		Lembucherra, Tripura		Shillongani, Assam	
	D50F	PPL	D50F	DTM	D50F	PPL	D50F	PPL
IPC 97-67	66	35.2	63.7	116	69.3	22.3	74	38.5
KWR 108	75	28.0	69.7	118	68.3	25.7	74	32.3
KPG 59	72	35.1	66.3	110	72.7	19.7	71	33.3
Subhra	67	26.2	50.3	100	72.3	46.0	73	32.2
DCP 92-3	67	20.8	59.7	105	64.0	27.3	72	47.5
JG 11	69	21.2	57.7	109	78.7	24.0	70	32.8
JG 16	68	21.0	63.3	110	77.7	29.7	71	45.5
JAKI9218	67	21.3	51.3	101	71.7	32.0	75	30.6
JSC 55	69	23.9	52.7	100	62.0	25.3	73	31.0
JSC 56	68	21.4	52.3	99	67.3	18.3	70	30.5
PUSA372	67	28.8	64.7	110	73.7	24.3	72	49.9
RAJAS	68	45.5	58.3	108	60.7	28.7	70	29.3
JG 14	67	34.0	58.3	108	67.7	20.7	72	28.3
PANTG186	73	42.4	69.0	117	72.7	24.0	70	39.6
C.D. (0.05)	4	5.1	1.33	5.1	1.7	9.5	-	-

*D50F: Days to 50% flowering, DTM: Days to 80% maturity, PPL: Pods/plant

Promotion of fieldpea in NEH region: There exists a good scope for growing peas (both vegetable and grains) in NEH region. Therefore, In this context, certain niche areas needing our consistent and urgent attention includes area expansion in hilly slopes and rice fallows, bridging yield gap with research through HYVs with improved agro-techniques, initiating small scale seed production activities involving farmers' participation and giving adequate thrusts to pulse-extension for imparting awareness to grow and consume pulses (Singh *et al.* 2017, 2018; Praharaj *et al.* 2014).

Other priorities areas therefore, includes land reclamation, developing and introduction of suitable varieties for *Jhum* areas, alternate cropping systems involving pulses as a component crop, introduction of short duration pulses such as catch crops and zero tillage for pea cultivation under optimum soil moisture condition (Praharaj *et al.* 2017, 2018; Nath 2019; Hazra 2019; Kumar 2019). These issues need to be addressed along with low pH and soil related constraints (Bhadana *et al.* 2013).

Varietal evaluation in fieldpea based on grain yield (Table 5) realized at NEH region indicated superior performance of AMAN (1290 kg/ha excluding the average yield of the local improved variety -TRCP series, while 1260 kg/ha including these improved ones) over many other cultivars. This was observed across 5 locations (excluding TRCP series) and 7 locations (including TRCP series) where

variety evaluation was made (Table 5). However, the improved variety viz., TRCP 9 (1604 kg/ha) was superior to all these cultivars at Shillongani and Tripura (with exception to VL 42) locations as this was developed and adapted under local conditions. Amongst all the fieldpea varieties, significantly higher yield was obtained in TRCP 9 followed by TRCP 8 (1494 kg/ha) and Aman (1260 kg/ha) over other varieties (Table 5). Similar trend was obtained in other yield attributes (Table 6). Therefore, for realization of higher grain yield, fieldpea cultivar AMAN could be promoted and popularized at Mizoram, Sikkim, Arunachal Pradesh, Manipur and Meghalaya locations while, TRCP9 at Assam and Tripura locations.

Promotion of mungbean in NEH region: Growing of short duration pre-kharif mungbean could play an important role for higher and quicker income and livelihood security in NEH region. Some of the mungbean varieties adopted to NEPZ could have higher yield potential in NEH region also. Evaluation of eight pre-kharif mungbean varieties based on grain yield (Table 7) at NEH region indicated superior performance of HUM 12 followed by IPM 2-14 (thereby reaching at the highest average productivity of 1072 and 1057 kg/ha, respectively across four locations, Table 7). This was followed by other improved varieties namely, IPM 2-3, Meha and Samrat (in the range of 1 t/ha). Therefore, for realization of higher grain yield, mungbean cultivar HUM 12 followed by IPM 2-14 could be promoted under NEH conditions (Table 7, 8).

Table 3. Grain yield (kg/ha) realized in lentil varieties across various NEH locations

Variety	ICAR-NEH Mizoram	ICAR-NEH Manipur	ICAR-NEH Tripura	CAU, Pasighat, Arun.Prad.	AAU, Shillongani Assam	CAU, Imphal, Manipur	ICAR-NEH Umiam, Meghalaya	Mean
HUL 57	1352	526	505	657	1113	774	415	763
IPL 316	1395	566	614	1243	1070	1655	455	1000
IPL 406	1372	1001	1351	380	957	1333	892	1041
DPL 62	1702	950	942	690	1266	1988	838	1197
DPL 15	1030	635	1248	459	833	1881	524	944
IPL 81	1408	516	1214	537	1477	1369	404	989
Tripura L.S.1	1667	917	656	527	1327	1214	706	1002
MOITRI	1207	820	1072	637	1200	1164	709	973
Pant Lentil 7	1485	607	849	537	1110	1119	495	886
C.D. (0.05)	180	101	94.1	75.3	94	128	412	266

Table 4. Yield attributes and other traits observed in lentil cultivars under different NEH locations*

Variety	Kolasib, Mizoram		Lamphelpat, Manipur	Lembucherra, Tripura		Shillongani, Assam		Pasighat, Arunachal Pradesh		CAU, Imphal, Manipur	
	D50F	PPL	D50F	D50F	PPL	D50F	PPL	D50F	PPL	D50F	PPL
HUL 57	67	55.1	61.3	70.3	41.7	81	23.0	58.7	87.6	81	60.9
IPL 316	68	54.4	62.3	70.0	34.7	79	25.6	54.0	86.1	81	47.6
IPL 406	69	53.5	60.7	69.7	31.0	80	28.5	61.7	14.7	77	51.5
DPL 62	71	55.0	62.3	75.3	20.0	76	19.6	65.0	55.9	77	59.5
DPL 15	70	55.8	61.7	78.3	22.0	81	19.4	60.3	58.4	81	57.7
IPL 81	70	55.3	61.0	65.3	38.7	84	42.0	65.0	49.0	77	61.3
Tripura L.S.1	68	49.3	52.3	56.7	27.0	80	36.0	62.3	27.1	78	55.4
MOITRI (WBL77)	68	52.2	62.0	68.7	24.7	77	39.4	65.0	43.6	81	51.7
Pant Lentil 7	67	47.9	62.3	68.0	30.3	77	26.4	67.7	28.5	82	52.1
C.D. (0.05)	NS	NS	1.51	1.1	13.2	-	-	2.5	8.7	5.1	2.6

*D50F: Days to 50% flowering, PPL: Pods/plant

Promotion of fababean in NEH region: Six fababean varieties evaluated for their performance at CAU, Imphal, Manipur indicated that fababean genotype ‘Patna 6’ (from ICAR-ER, Patna) had significantly higher grain yield (891 kg/ha) over the rest of the varieties due to higher 100-seed weight (23.6 g). The genotype performed better over other two released varieties viz., Swarna Suraksha and Swarna Gaurav (Table 9). Although seeds were sent to 3 different locations for variety evaluation, it could not be tested during 2015-16 (and thus, needed to be validated further).

Seed multiplication in NEH region: Seed multiplication programme was also undertaken in NEH region to strengthen seed production and its distribution (Table 10). Seed production to the tune of a total of 1890 kg fieldpea, 3390 kg lentil, 28000 kg Rajmash, 840 kg Mungbean and 1100 kg urdbean were produced at NEH locations (inclusive of breeder and TL seeds) during 2015-16. Therefore, a total of 3120 kg of breeder seeds of pulses (besides 32100 kg of TL seeds) was produced by NEH centres. Varietywise details were also given in Table 10.

On centre basis, Lembucherra (Tripura) location produced 1200 kg breeder seed (1060 kg fieldpea TRCP 8 and 40 kg mungbean Tripura mung 1 along with 100 kg of blackgram Tripura Muskolai) and 32100 kg truthfully level seed (pertaining to lentil, rajmash, mungbean and urdbean).

Similarly, Shillongani (Assam) centre produced 1620 kg of breeder seed of pulses pertaining to different fieldpea (530 kg) and lentil (1090 kg) varieties (Table 10). Central Agricultural University, Imphal (Manipur) centre produced 300 kg breeder seed of fieldpea Prakash during 2015-16. Besides these, seeds were also planned to be multiplied during rainy and winter seasons (2016-17). During 2014-15, 250 kg of chickpea (JG 16), 1800 kg fieldpea, 8350 kg of lentil and 32000 kg of rajmash were produced at Tripura and Assam locations. Three major states viz., Tripura (Lembucherra), Assam (Shillongani) and Manipur (CAU, Imphal) contributed to the above seed production programme under NEH region (Anonymous 2016).

From the above varietal evaluation of major winter/pre-monsoon pulses across the locations, it was inferred that chickpea PUSA 372 and IPC 97-67, lentil DPL 62, fieldpea Aman and mungbean HUM 12 and IPM 2-14 at most of the locations; while TRCP 9 at Assam and Tripura locations could be promoted under NEH conditions.

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Table 5. Grain yield (kg/ha) realized in fieldpea varieties across different NEH locations

Variety	Kolasib, Mizoram	Tadong, Sikkim	CAU, Pasighat Arun. Pr.	CAU, Imphal Manipur	ICAR NEH, Umiam, Meghalaya	Mean (5 Centres)	AAU, Shillongani Assam	ICAR NEH Lembucherra, Tripura	Mean (7 Centres)
HUDP 15	1735	1187	479	766	415	916	894	1407	983
Adarsh	1598	1263	464	1102	455	976	1067	1372	1046
Aman	1813	1556	417	1875	790	1290	967	1402	1260
Vikas	1243	1327	812	1007	738	1025	1351	1289	1110
Prakash	1323	1222	484	1545	524	1020	792	1299	1027
IPFD 6-3	1607	1257	478	1589	404	1067	1020	1583	1134
IPFD 11-5	1482	1181	612	738	706	944	1350	1351	1060
VL 42	1443	1316	390	842	709	940	779	1870	1050
TRCP 8	-	-	-	-	-	-	1208	1779	1494
TRCP 9	-	-	-	-	-	-	1471	1737	1604
Rachna	-	-	-	-	213	-	-	-	-
C.D. (0.05)	208	161	NS	190	436	297	178	157	427

Table 6. Yield attributes and other traits observed in fieldpea cultivars at NEH region*

Variety	Kolasib, Mizoram		Lamphelpat, Manipur		Tadong, Gangtok (Sikkim)		Lembucherra, Tripura		Pasighat (CAU) Arunachal Pradesh		Shillongani, Assam		Umiam, Meghalaya
	D50F	PPL	D50F	PPL	D50F	PPL	D50F	PPL	D50F	PPL	D50F	PPL	D50F
HUDP 15	68	21.2	78.9	80	8.1	76.7	5.7	63.0	5.7	66	15.0	71	
Adarsh (IPF 99-25)	63	15.9	77.0	68	12.6	62.3	5.3	54.0	4.5	71	17.4	61	
Aman (IPF 5-19)	68	16.7	81.2	69	14.7	77.7	5.7	56.7	3.8	65	14.2	74	
Vikas (IPFD 99-13)	64	8.7	77.5	81	7.1	67.0	4.3	61.0	7.9	72	14.6	58	
Prakash (IPFD 1-10)	62	13.8	77.5	67	10.6	70.7	5.3	57.0	4.9	68	15.4	63	
IPFD 6-3	68	12.3	82.0	80	7.9	75.0	8.0	62.3	4.9	68	16.5	70	
IPFD 11-5	62	15.8	78.5	73	10.5	62.0	5.0	55.0	5.9	70	15.0	63	
VL 42	61	17.7	81.0	69	12.2	61.0	4.0	55.0	5.1	70	17.0	61	
TRCP 8	-	-	-	-	-	85.7	6.0	-	-	66	14.9	-	
TRCP 9	-	-	-	-	-	77.3	5.3	-	3.8	65	19.9	-	
C.D. (0.05)	3.0	2.9	3.2	2.1	3.5	1.2	NS	8.4	-	-	-	4.5	

* D50F: Days to 50% flowering, PPL: Pods/plant

Table 7. Grain yield (kg/ha) realized in mungbean varieties across NEH locations

Variety	Kolasib, Mizoram	Shillongani Assam	Lamphelpat, Manipur	Lembucherra, Tripura	Mean
DGGS 4	963	937	848	773	880
HUM 12	1017	1177	585	1509	1072
HUM 16	955	1094	255	1224	882
Narendra mung 1	837	1333	468	1039	919
Meha	1011	1250	614	980	964
IPM 2-14	987	1198	604	1440	1057
IPM 2-3	953	927	767	1318	991
Samrat (PDM 139)	880	1146	602	1192	955
CD (0.05)	28.2	134	182	246	NS

Table 8. Yield attributes and other traits observed in mungbean cultivars at NEH region*

Variety	Kolasib, Mizoram			Lamphelpat, Manipur		Lembucherra, Tripura		Shillongani, Assam	
	D50F	PPL	DTM	D50F	PPL	D50F	PPL	D50F	PPL
DGGS 4	33	19.7	60	47.3	15.1	38.3	15.0	35	9.0
HUM 12	37	21.3	61	48.3	9.3	38.7	27.3	34	11.9
HUM 16	32	20.7	60	52.3	5.5	39.3	13.0	34	15.9
Narendra mung 1	35	19.8	61	52.3	9.3	42.7	17.3	38	17.0
Meha	36	20.7	60	52.7	9.6	40.7	27.0	33	12.9
IPM 2-14	33	20.3	60	49.3	7.9	43.7	15.3	35	11.0
IPM 2-3	34	19.8	59	50.0	8.7	43.7	23.0	35	14.6
Samrat (PDM 139)	36	19.4	60	52.3	5.9	40	22.7	36	12.0
CD (0.05)	3.0	0.8	NS	2.3	2.2	1.9	NS	-	-

* D50F: Days to 50% flowering, DTM: Days to 80% maturity, PPL: Pods/plant

Table 9. Phenology and grain yield of fababean varieties realized at CAU, Imphal*

Genotype	D50F	DTM	Grain yield (kg/ha)
Swarna Suraksha	69.3	130	625
Swarna Gaurav	70.0	131	637
Patna-3	70.0	129	764
Patna-4	70.0	129	752
Patna-5	68.7	131	741
Patna-6	69.7	130	891
C.D. (0.05)	1.0	1.0	62

* D50F: Days to 50% flowering, DTM: Days to 80% maturity

Table 10. Breeder seed production in pulses through seed multiplication programme at NEH centres

Pulse	Centres	Variety	Quantity produced (kg)
Fieldpea	Shillongani, Assam	Aman	200
		Prakash	250
		HUDP 15	80
		TRCP-8	1060
		Prakash	300
Lentil	Lembucherra, Tripura	Tripura Lentil Sel 1 (Lentil)	2300*
	CAU, Imphal, Manipur		
	Shillongani, Assam	KLS 218	680
		PL 406	100
		HUL 57	80
		Moitri	120
		DPL 62	110
Rajmash	Lembucherra, Tripura	Tripura Rajmash 1 (Rajmash)	28000*
Mungbean	Lembucherra, Tripura	Tripura Mung 1	40 +800*
Urdbean	Lembucherra, Tripura	Tripura Maskolai	100+1000*
Total (*includes TL seeds)			3120 + 32100*

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