Gap in Adoption of improved Pulse Production Technologies in Uttar Pradesh

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ABSTRACT

Pulses on account of their vital role in nutritional security and soil ameliorative properties have been an integral part of sustainable agriculture since ages. They had been grown with cereals not only for meeting the diversified household needs in the country but also for maintaining favourable equilibrium in agricultural production system. In spite of appreciable advances in the technology front, pulses production in the country has shown only marginal increase during the past two and a half decade, because pulses have been pushed into low endowed lands with more risk prone situations. The present study was undertaken in Hamirpur and Kanpur Nagar districts of Uttar Pradesh to delineate pulse-based cropping systems, related technologies and identify the gap in technology adoption. The major pulse based cropping systems of district Hamirpur are Pigeonpea + sorghum (mixed cropping), Urdbean – wheat, Urdbean – chickpea, Fallow – lentil and Fallow – chickpea whereas in district Kanpur Nagar Pigeonpea + sorghum (mixed cropping), Urdbean – wheat and Maize – chickpea are the major pulse based cropping systems. Gap in technology adoption in major pulse crops both in rainfed and irrigated cropping had been identified. The overall gap in adoption of technologies was more in rainfed situation than irrigated situation.

Key Word: *Adoption gap; Pulse crops; Improved technologies;*

The high input technology driven model was instrumental in increasing crop yields globally. Most of the developing countries like India, which were plagued by severe food crisis, replicated the success achieved by this model in the first world countries under the aegesis of green revolution. Central to this production oriented system was the assumption that technologies were universal and they existed independently of social and ecological contexts. However, this assumption could not suit the complex, diverse and risk prone environments of resource poor agriculture, mostly in the developing countries. Resource-poor farmers in the rainfed ecosystems practice less-intensive agriculture, and since their income depend on local agriculture, they benefit little from increased food production in irrigated areas (*Johansen, 2000*). Viable rotation of crops, one being a profitable pulse, is needed to improve the overall profitability, sustainability and diversity of the farming systems (*Joshi,2002*). Rainfed agriculture accounts for more than 40% of total food grain production, 75% of oilseeds and 90% of pulses. Pulses on account of their vital role in nutritional security and soil ameliorative properties have been an integral part of sustainable agriculture since ages. They had been grown with cereals not only for meeting the diversified household needs in the country but also for maintaining favourable equilibrium in agricultural production system. However, with the introduction of Green Revolution technologies particularly in cereals, this equilibrium appears to be disturbed in the recent past, resulting into the emergence of second generation problems particularly in those areas which matter most in the national food grains production. Presently, the pulses are grown on around 23 million hectares area with 13 – 15 million tonnes of production. In the past five decades, pulses production has not kept up with growth in demand calling for import to the tune of 0.5 to 1.5 million tonnes (*Roy, 2006*).

The issues of nutritional security and pulses production being the priority in the national agenda, the urgency is being felt to break the yield plateau for rapid gains in pulses production. To overcome these problems, there is an urgent need to increase pulses production with annual growth rate of 4%. In spite of appreciable advances in the technology front, pulses production in

the country has shown only marginal increase during the past two and a half decade, because pulses have been pushed into low endowed lands with more risk prone situations. As a result, the contribution of pulses in the national food basket has drastically been reduced to 7% from 17% at the time of independence. A need has been felt to identify the gap in technology adoption in pulse crops so that appropriate measure can be taken to emphasise the adoption of improved technology, which will ultimately lead to increased productivity and production. The present study was undertaken with the objective: To delineate pulse-based cropping systems, related technologies and identify the gap in technology adoption.

METHODOLOGY

Two districts – Kanpur Nagar and Hamirpur have been selected purposively as these two districts represent irrigated and rainfed cropping systems, respectively. Two blocks each from two districts were randomly selected for the study *i.e.*, Kalyanpur and Bidhnu from Kanpur Nagar and Sumerpur and Maudha from Hamirpur. From each block, two villages were selected on random basis. Ramelnagar and Singhpur villages were selected from Kalyanpur block and Jamu and Garewa Mohasinpur villages were selected from Bidhnu block of Kanpur Nagar district. Vidokhar and Ingohta villages were selected from Sumerpur block and Makraon and Atarra villages were selected from Maudha block of Hamirpur district. Thus, a total of eight villages were selected from four blocks of two districts for the purpose of drawing the sample of respondents for the study. Twenty farmers each from 8 villages were selected for the study. Total numbers of farmer selected for the study were 160. A structured interview schedule was developed for collection of data from different sections of respondents. Information was collected through personal interview method. The purpose of interview was clearly explained to each respondent. The collected information was analysed and interpreted.

RESULTS AND DISCUSSION

Data were collected from the farmers of Hamirpur and Kanpur Nagar districts about the prevalent pulse based cropping systems and related technologies.

Major Pulse based Cropping Systems: In district Hamirpur, pulse based cropping systems were more prevalent due to limited rainfall and irrigation facilities. Due to very limited irrigation facility, *kharif* was mostly kept fallow while some area was covered with pigeonpea, which was grown as a mixed crop with sorghum. Sorghum was very important as a grain and fodder both. In *rabi* season, farmers mainly grew wheat as it was their staple food. But pulses like chickpea and lentil were also grown on large areas. The major pulse based cropping systems of district Hamirpur were: i) Pigeonpea + sorghum (mixed cropping), ii) Urdbean – wheat, iii) Urdbean – chickpea, iv) Fallow – lentil and v) Fallow – chickpea. Table 1 displayed the area under the major pulse based cropping systems. Pigeonpea + sorghum (mixed cropping) covered 15.25% of net sown area. The net sown area of the four study villages of district Hamirpur is 1862 hectare. Out of this, urdbean – wheat crop rotation was being practised in 580.9 hectare area (31.2%). Urdbean – chickpea was another popular cropping system. In district Hamirpur, the demand for green colour urdbean was high as compared to black urdbean. So, farmers preferred to grow green urdbean. After urdbean farmers used to grow wheat as well as chickpea in *rabi* season. A large area was kept fallow in *kharif* season. The soil of this area was heavy clay and with the residual moisture, chickpea and lentil were grown with very less input.

Table 1. Area under Major Pulse Based Cropping Systems in Hamirpur (Total area in four villages-1862 hectare)

Cropping systems	Area (ha)	%age
Pigeonpea + sorghum (mixed)	283.95	15.25
Urdbean – wheat	580.9	31.2
Urdbean – chickpea	478.5	25.7
Fallow – lentil	340.7	18.3
Fallow – chickpea	597.7	32.1
Others	173.3	9.3

Table 2. Number of Farmers Practising Major Pulse Based Cropping Systems in Hamirpur (N = 80)

Cropping system	N	%age
Pigeonpea + Sorghum (mixed)	30	37.5
Urdbean – Wheat	57	71.25
Urdbean – Chickpea	42	52.5
Fallow – Chickpea	46	57.5
Fallow – Lentil	22	27.5

Urdbean-wheat cropping system was the most popular. 71.25% respondents preferred to follow this cropping system (Table 2). Fallow – chickpea and urdbean – chickpea were also very popular among the farmers, 57.5% and 52.5% farmers followed these two cropping systems. The major pulse based cropping

systems of district Kanpur Nagar were: i) Pigeonpea + sorghum (mixed cropping), ii) Urdbean – wheat and iii) Maize – chickpea. Table 3 to 4 depicted the area under major pulse based cropping systems, number of farmers practising pulse based cropping system and distribution of pulses in different soil types in district Kanpur Nagar. In Kanpur, the area of pulses was very less as compared to district Hamirpur. The soil types and irrigation facilities promoted farmers to cultivate more cereal crops. Pulses were grown on marginal lands.

Pigeonpea + sorghum mixed cropping system had coverage of 31.6 hectare area out of 458 hectare net sown area in four villages of district Kanpur Nagar. Urdbean – wheat was also being cultivated in 23.7 hectare followed by maize – chickpea (20.4 hectare, Table 3). Out of 80 respondents of Kanpur Nagar district, 18 respondents followed maize – chickpea cropping system. Almost 13% farmers practised pigeonpea + sorghum mixed cropping system.

Table 3 Area under Major Pulse Based Cropping Systems in Kanpur Nagar (Total area in four villages-458 hectare)

Cropping system	Area (ha)	%age
Pigeonpea + Sorghum (mixed)	31.6	6.9
Urdbean – Wheat	23.7	5.25
Maize – Chickpea	20.4	4.52

Table 4. Number of Farmers Practising Major Pulse Based Cropping Systems in Kanpur Nagar (N = 80)

Cropping system	N	%age
Pigeonpea + Sorghum (mixed)	10	12.5
Urdbean – Wheat	14	17.5
Maize – Chickpea	18	22.5

Technology Gap of Pulse Based Cropping Systems: Data were collected from the respondents about the technologies of pulse based cropping systems being followed by them. The production technologies of different crops in district Hamirpur were described and compared with the recommended technologies. The existing, recommended technologies of pigeonpea and the gap between the existing and recommended technologies was presented in Table 5. Farmers in general use local varieties instead of the recommended improved varieties as the quality seed of improved varieties are not easily available. Very few farmers were able to arrange improved variety seed. Farmers followed broadcast method of sowing against the recommended line sowing and because of this, they applied higher seed rate than the recommended. No sulphur fertiliser was applied as recommended. Full gap was observed in case of irrigation and plant protection in pigeonpea.

Table 5. Level of use and gap in adoption of pigeonpea technologies in Hamirpur

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	UPAS 120 (short duration), Bahar, Amar, NA 1, Mal13 (long duration)	Local	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	@ 15 Kg/ha (UPAS 120), 15 – 20 Kg/ha (long duration) (line sowing)	@ 20 – 25 Kg/ha) (broadcast)	Higher seed rate, no line sowing
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	DAP @ 30-35 Kg/ha	65 – 70 Kg DAP/ha, no Gypsum
Weeding	Two mechanical weedings or Pendimethelin @ 3.3 litre/ha	Two mechanical weedings	Chemical weeding isnot done
Irrigation	One irrigation in October last to November 1st fortnight (long duration)	Nil	Full gap
Plant protection	Endosulphan (35 E.C.) 1.5 litre/ha or Monocrotophos (36 E.C.) 0.8 litre/ha or NSKE 5% or NPV (350 LE) or seed treatment with Thiram: Carbendazim (2:1) @ 3 gm/Kg seed	Nil	Full gap

*Gap between recommended and existing technologies

Table 6. Level of use and gap in adoption of urdbean technologies in Hamirpur

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	Pant Urd 19, Narendra Urd 1, IPU 94-1	Local	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	15 Kg/ha (line sowing)	8 – 10 Kg/ha (broadcast)	Lower seed rate, no line sowing
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	No fertiliser use	Full gap
Weeding	Two mechanical weedings or Pendimethelin @ 3.3 litre/ha	Two mechanical weedings	Chemical weeding is not practised
Irrigation	Nil	Nil	Nil
Plant protection	Dimethioate (30 E.C.) @ 5 litre/ha or	Nil	Full gap

*Gap between recommended and existing technologies

Table 7. Level of Use and Gap in Adoption of Chickpea Technologies in Hamirpur

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	Avarodhi, KWR 108, BG 256, DCP 92-3	Local (small seeded), Radhey, K 850 (bold)	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing, 2 ploughings	Nil
Seed rate	75 – 90 Kg/ha (line sowing)	90 – 100 Kg/ha (line sowing)	Higher seed rate
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	DAP @ 50 Kg/ha	Less fertiliser use
Weeding	One mechanical weeding or Pendimethelin @ 3.3 litre/ha	No weeding	Full gap
Irrigation	One irrigation at pre-flowering stage	Nil	Full gap
Plant protection	Endosulphan (35 E.C.) 1.5 litre/ha or Monocrotophos (36 E.C.) 0.8 litre/ha or NSKE 5% or NPV (350 LE) or seed treatment with Thiram: Carbendazim (2:1) @ 3 gm/Kg seed	Nil	Full gap

*Gap between recommended and existing technologies

Table 8. Level of use and gap in adoption of pigeonpea technologies in Kanpur Nagar

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	UPAS 120 (short duration), Bahar, Amar, NA 1, Mal13 (long duration)	Local, Bahar, UPAS 120	Partial gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	@ 15 Kg/ha (UPAS 120), 15 – 20 Kg/ha (long duration) (line sowing)	@ 20 – 25 Kg/ha (broadcast)	Higher seed rate, no line sowing
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	DAP @ 50 Kg/ha	Less DAP, no Gypsum
Weeding	Two mechanical weedings or Pendimethelin @ 3.3 litre/ha	Two mechanical weedings	Chemical weeding is not done
Irrigation	One irrigation in October last to November 1st fortnight (long duration)	Nil	Full gap
Plant protection	Endosulphan (35 E.C.) 1.5 litre/ha or Monocrotophos (36 E.C.) 0.8 litre/ha or NSKE 5% or NPV (350 LE) or seed treatment with Thiram: Carbendazim (2:1) @ 3 gm/Kg seed	Endosulphan (0.7%) @ 0.75 litre/ha	Full gap

*Gap between recommended and existing technologies

Table 6 described the gap between the existing and recommended technologies of urdbean in district Hamirpur. The findings indicated that improved varieties were not grown as the seed is not available. Farmers applied lower seed rate than the recommended dose. No fertiliser was applied by the farmers and full gap was noted in plant protection.

The gap between the existing and recommended technologies of chickpea in district Hamirpur was presented in Table 7. Full gap was observed in use of improved variety, weeding, irrigation and plant protection, which definitely was the reason of not achieving the potential yield. Farmers used local or age-old variety in place of improved varieties. Unavailability of seed and lack of awareness were the main reasons.

The existing and recommended production technologies of different crops in district Kanpur Nagar were described. The gap between the existing and recommended technologies was also discussed. The existing, recommended technologies of pigeonpea and the gap between the existing and recommended technologies were presented in Table 8. Farmers in district Kanpur Nagar applied higher seed rate and broadcasted the seed as being practised in district Hamirpur. As the farmers followed broadcast method of sowing against the recommended line sowing, they applied higher seed rate than the recommended. Full gap was observed in irrigation and plant protection. Mechanical weeding was done as per recommendation but the chemical method was not used since it was not cost effective.

Table 9 described the gap between the existing and recommended technologies of urdbean in district Kanpur Nagar. The improved varieties were not grown as the seed was not available. Farmers applied lower seed rate than recommended. No fertiliser was applied by the farmers and full gap was noted in plant protection. Similar trend was observed in both districts Hamirpur and Kanpur Nagar regarding gap in existing and recommended technologies.

Table 9. Level of Use and Gap in Adoption of Urdbean Technologies in Kanpur Nagar

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	Pant Urd 19, Narendra Urd 1, IPU 94-1	Local	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	15 Kg/ha (line sowing)	10 – 12 Kg/ha (broadcast)	Lower seed rate, no line sowing
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	No fertiliser use	Full gap
Weeding	Two mechanical weedings or Pendimethelin @ 3.3 litre/ha	Two mechanical weedings	Chemical weeding is not practised
Irrigation	Nil	Nil	Nil
Plant protection	Dimethioate (30 E.C.) @ 5 litre/ha or Endosulphan (35 E.C.) 1.5 litre/ha	Nil	Full gap

*Gap between recommended and existing technologies

Table 10 Level of Use and Gap in Adoption of Chickpea Technologies in Kanpur Nagar

Crop Operations	Recommended technologies	Existing technologies	Gap*
Variety	Avraodhi, KWR 108, BG 256, DCP 92-3	Desi (small seeded), Radhey, K 850 (bold), Avrodhi (medium)	Full gap
Land preparation	One cultivator ploughing and 2 ploughings	One cultivator ploughing and 2 ploughings	Nil
Seed rate	75 – 90 Kg/ha (line sowing)	100 Kg/ha (line sowing)	Higher seed rate
Fertiliser	DAP @ 100 Kg/ha + Gypsum @ 200 Kg /ha	DAP @ 50 Kg/ha	Less fertiliser use
Weeding	One mechanical weeding or Pendimethelin @ 3.3 litre/ha	No weeding	Full gap
Irrigation	One irrigation at pre-flowering stage	One irrigation	Nil
Plant protection	Endosulphan (35 E.C.) 1.5 litre/ha or Monocrotophos (36 E.C.) 0.8 litre/ha or NSKE 5% or NPV (350 LE) or seed treatment with Thiram: Carbendazim (2:1) @ 3 gm/Kg seed	Nil	Full gap

*Gap between recommended and existing technologies

Table 11. Gap in technology adoption

Crop	Variety	Technology wise Mean score of technology gap						Total score
		Land preparation	Seed rate	Fertiliser	Weeding	Irrigation	Plant protection	
Hamirpur								
Pigeonpea	2.25	1.33	1.98	2.09	2.64	2.54	2.71	15.54
Urdbean	2.53	1.46	2.15	2.65	2.04	—	2.84	13.67
Chickpea	2.54	1.41	1.94	2.08	2.49	2.44	2.55	15.45
Kanpur								
Pigeonpea	2.16	1.49	2.05	2.08	2.15	2.24	2.55	14.72
Urdbean	2.51	1.29	2.04	2.58	1.98	—	2.47	12.87
Chickpea	2.48	1.35	1.94	1.91	2.43	1.41	2.46	13.98

The gap between the existing and recommended technologies of chickpea in district Kanpur Nagar was presented in Table 10. Farmers irrigated once as recommended whereas in district Hamirpur farmers did not irrigate chickpea crop. Farmers used higher seed rate and less fertiliser than the recommended dose. Farmers used local or age-old variety in place of improved varieties. Unavailability of seed and lack of awareness were the reason.

The gap in technology adoption was studied and the data in Table 11 showed the technology wise mean score and total score of technology gap in the selected pulse crops in both the districts.

It was reported that the overall gap in adoption of technologies was more in rainfed situation than irrigated situation. This might be due to more resource endowment in irrigated situation, more profitability of cropping system and affordability of farmers in trying out input intensive technologies.

CONCLUSION

Gap in technology adoption in major pulse crops both in rainfed and irrigated cropping had been identified. The overall gap in adoption of technologies was more in rainfed situation than irrigated situation. In most of the pulses, farmers did not follow the recommended practices for irrigation, plant protection, use of improved seed. Farmers in general used local varieties instead of the recommended improved varieties as the quality seed of improved varieties were not easily available. Availability of improved variety seeds should be ensured by the line departments and seed production agencies. Skill oriented both on the field and off the field training programmes should be organised to demonstrate the process of preparing and application of plant protection chemicals and bio-agents to control pest infestation. Transfer of technology in relation to pulses should be strengthened in farmer participatory mode with active involvement of multidisciplinary team of researchers.

REFERENCES

1. Johansen, C. (ed.); Duxbury, J. M. (ed.); Virmani, S. M. (ed.); Gowda, C. L. L. (ed.); Pande, S. (ed.) and Joshi, P. K. (2000). Legumes in rice and wheat cropping systems of the Indo-Gangetic Plain: constraints and opportunities. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); Patancheru; India. ii + 223 pp.
2. Joshi, P. K.; Saxena, Raka and Saxena, R. (2002). A profile of pulses production in India: facts, trends and opportunities. Sixty second Annual Conference of the Indian Society of Agricultural Economics, held at ICAR, New Delhi, 19-21 December 2002. *Indian J. Agril. Eco.* **57**(3), 326-339
3. Roy Burman, R.; Singh, S. K.; Singh, Lakhan and Singh, A. K. (2006). Adoption of Improved Pulses Production Technologies and related Constraints in Uttar Pradesh. *Indian J. Pulses Res.***19** (1): 104-106.