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Impact of knowledge gap in enhancing yield among pulse growers of Cauvery delta region

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Abstract

An ex-post facto research was undertaken to assess the knowledge gap hindering yield maximization among pulse growers of Cauvery delta region during 2020-2021 with 200 farmers. Farmers obtained yield increase of 8.74% in redgram, to 49.15% in blackgram and higher net returns upto Rs. 29657/ha through KVK interventions led to less knowledge gap index in YMV resistant varieties and other yield maximizing technologies. Mean knowledge gap scores obtained for blackgram, greengram, redgram and horsegram are 24.48, 23.6, 22.6 and 20.6 respectively with highest score for blackgram cultivated both as rice fallow and sole crop adopting yield maximizing technologies. Pulse growers belonged medium overall knowledge gap index (KGI) category. High KGI was observed for the pulse technologies amendments for soil surface crusting, soil application of TNAU mineral mixture, foliar spray of KCl and 1% urea, seed coating with bio fertilizers and micronutrients and pest and disease control by chemicals. Though farmers faced constraints (Garret ranking) hindering yield and income *viz*., pest and diseases, poor marketing guidance, lack of technical know-how) and low market price, area in pulses cultivation expanded by 276 ha. The study concluded that knowledge gap has direct influence on productivity per unit area in pulses.

Keywords: Knowledge gap index, constraints, impact, yield, net returns, pulse technologies

Introduction

In the world, India being the largest producer and consumer of pulses with more than 28 million ha area in 2021-22 but the per capita availability of pulses has reduced to 53 gm/day. Pulses account for 20 to 25 percent protein which is twice than that of wheat and thrice of rice. India, ranks first in area (31%) and production (28%) with significant increase in productivity @ 885 kg/ha in 2020-21 over last five years. (Dept. of Pulses development, GOI, 2021-22). Amutha (2011) [1] enumerated that production and consumption of pulses are essential for food and/ nutritional security and pulses cultivation helps in maintaining soil fertility by way of nitrogen fixation. Nagarajan *et al.* (2004) [9] reported that Cauvery Delta Zone (CDZ) accounts for major area and production in pulses and cultivated as a relay crop with minimal or no tillage condition utilizing the residual moisture and nutrients. The CDZ in Tamil Nadu accounts for 11% of the state area (1.45 million ha) as rice fallow pulses are cultivated regularly in December- January and contributes more than 40% of pulse production. Even though rice fallow pulses covers an area of 3.1 lakh ha, low yield @ 300 to 500 kg/ ha only obtained compared irrigated crop. In Tiruchirappalli district, 9438 ha (normal area 22900 ha) is covered by major pulses, of which black gram and green gram are mainly under both rain fed and rice fallow, where red gram and horse gram are mainly under rainfed conditions. The yield of pulses is very low in the study district due to unaware of improved varieties, lack of awareness and lesser adoption of improved production technologies by the farmers. Therefore, the present study was undertaken during 2020-2021 as a University Research Project and assessed the knowledge gap among the pulse growers about various yield maximising pulse technologies, constraints faced and impact on yield, facilitating the policy makers of research institutions and the government in improving productivity of pulses.

Materials and Methods

The ex post facto research study “Impact of KVK Interventions on Minimising Yield Gap in Pulses under Rice

Fallow and Sole crop cultivation in Tiruchirappalli district" was conducted during 2020-2021 with 200 farmers from 18 villages of 9 blocks @ 50 farmers per pulse crop *viz.*, blackgram, greengram, redgram and horsegram using simple random and purposive sampling techniques (based on area under cultivation and marginal and small farmer category). As per Kundu *et al.* (2013) [7], knowledge gap of pulse growers was measured by calculating the knowledge score for a set of 20 questions on pulses yield maximizing technologies. Each answer is assigned score of 2. For each farmer, the score arrived by adding together his/her score for 20 knowledge items and knowledge gap index is calculated as:

$$\text{Knowledge Gap Index (KGI)} = \frac{Kp - Ko}{Kp} \times 100$$

Kp is the Maximum possible score of a farmer (*i.e*. 40) and Ko is the Obtained knowledge score by a farmer. The formula clearly reveals that range of knowledge gap index is from 0 to 100, wherein zero score denoted very low knowledge gap and the highest knowledge gap by score of 100. Kundu *et al.* (2013) [7]

Zalkuwi *et al.* (2015) [15] narrated that Garrett's Ranking method provides the change of order of constraints that are arranged based on their severity from the point of view of respondents. Garrett and Woodworth (1969) [16] has given following formula for converting ranks into percent:

$$\text{Percent position} = \frac{100 \times (Rij - 0.5)}{Nj}$$

In the above formula, Rij is rank given for i^{th} constraint by j^{th} individual and Nj is number of constraints ranked by j^{th} individual. By referring to the Garrett and Woodworth (1969) [16] table, the percent position of each rank will be converted into scores. Each factor of constraint is calculated by adding the scores of individual respondents and dividing by the total number of respondents and the mean scores for all the constraints will be arranged in descending order and ranked accordingly.

Results and Discussion

Knowledge Gap Index (KGI) analysis

From table 1, least KGI was observed in blackgram, for pre emergence weedicides application, TNAU/ICAR Yellow Mosaic Virus (YMV) resistant varieties (VBN 6, VBN 8 & MDU 1), Diammonium phosphate (DAP) and TNAU pulse wonder foliar spray, seed treatment with bio fertilizers and bio control agents and seed treatment for storage while in greengram, least KGI was observed for TNAU/ICAR YMV resistant varieties (CO (Gg) 8) and pre emergence weedicides application. In redgram, seed rate, pre emergence weedicides application, TNAU/ICAR YMV resistant varieties CO (Rg) 7, and in horsegram Paiyur 2 variety, only seed rate recorded with least KGI mainly for the reason that farmers were exposed to these technologies through KVK interventions. High KGI was observed for the technologies amendments for soil surface crusting, soil application of TNAU MN mixture, foliar spray of Potassium chloride (KCl for moisture stress), foliar spray of 1% urea (for yield), seed coating with bio fertilizers and micronutrients and pest and disease control by chemicals while KGI of 100 recorded for mechanized sowing behind seed drill in redgram and horsegram. The reason that pulse crops are not grown commercially like other crops and are given less significance in adoption of such yield maximizing technologies.

The knowledge gap score ranged from 20 to 38 in black gram, 18 to 36 in green gram, 16 to 32 in red gram and 12 to 28 in horse gram in accordance with scoring system. Mean of scores obtained for blackgram, green gram, red gram and horse gram are 24.48, 23.6, 22.6 and 20.6 respectively with highest score for black gram and least for horse gram. The reason is that black gram is widely cultivated both as sole crop under seed production and also as rice fallow crop while horsegram cultivated in lesser area by few interested farmers for home grain and fodder purpose. Standard deviation for black gram is 5.15, for green gram 5.27, for red gram 4.34 and for horse gram is 5.35, highest observed for horse gram. Based on the overall knowledge gap index, the pulse growers were categorized into three groups and found belonged to the medium knowledge gap index irrespective of pulses grown mainly due to interventions of KVK like On Farm Trials (OFT), Front Line Demonstrations (FLD), Cluster FLDs, trainings and mass awareness programmes. Low KGI was found in black gram and green gram as these two crops are highly grown in the rice fallow belt than sole crop of red gram and horse gram. The KGI was medium to high in horse gram which is the least cared crop grown mainly for home purpose grains and fodder and are getting low yield. (Table 2)

Kundu *et al.* (2013) [7] also reported similar findings that all the respondent farmers had knowledge gap in pulse crop production ranged from low (35.7%) to high (8%) with majority (56.3%) of them belonged to the medium knowledge gap category and obviously, farmers with a low knowledge gap are supposed to harvest some quantity of pulses. Saravanakumar *et al.* (2020) [12] revealed that there existed average extension gap of 1.29 q/ha, technology gap of 0.79 q/ha and technology index of 8.35 percent and that adoption of improved production technologies minimizes the yield gap and provided higher return to the farming community. Findings of Kumar *et al.* (2023) [6], Singh *et al.* (2020a) [13] and Singh *et al*. (2020b) [14] are similar.

Constraints in adoption of yield maximizing pulse technologies - Garett ranking

From the table 3, it is clearly evident that, among the ten factors of constraints faced by the pulse growers, pests and diseases (78. 5) ranked first followed by poor marketing guidance (75.4), lack of technical know-how (75.1), low market price/price fluctuation (74.7), exploitation by input dealers /private agencies (71.3) as the fifth rank. The main reason is, the farmers cultivated pulses either as rice fallow or sole crop with limited investment to reap more profit and hence showed lesser interest in gaining knowledge about pest and disease management technologies or to mitigate them which can be managed by imparting regular training and hands on materials be distributed to the farmers on pet and disease management practices in pulses improving their technical knowledge and enhance their yield/net income

(Puja *et al.* 2019) [11]. Price fluctuation and exploitation by input dealers could be eliminated by alterations in sowing time to prepone the harvest and that government minimum support price shall be provided for pulse crop. Similar findings reported by Oinam and Sudhakar (2014) [10], Biswas *et al.* (2017) [2], Marbaniang and Pasweth (2017) [8] and Khuvung *et al.* (2022) [5] in various crops.

Table 1: Knowledge gap index on Yield maximizing technologies in Pulses among farmers of Tiruchirappalli district (2016-2021)

(n=200)

S. No.	Yield maximizing technologies in Pulses	Knowledge gap index			
		Black gram	Green gram	Red gram	Horse gram
1.	TNAU/ICAR YMV resistant varieties	8	10	30	42
2.	Amendments for soil surface crusting	82	86	76	82
3.	Seed rate	38	42	4	22
4.	Seed treatment with chemicals	48	56	62	66
5.	Seed treatment with bio fertilizers	22	38	54	62
6.	Seed treatment with bio control agents	38	60	62	64
7.	Mechanized sowing behind seed drill	22	30	100	100
8.	Soil application of ZnSo4 (irrigated)	38	54	62	78
9.	Soil application of TNAU MN mixture	62	68	72	78
10.	Foliar spray of 1% urea (for yield)	58	66	68	62
11.	Foliar spray of KCl (moisture stress)	62	70	76	78
12.	Seed coating with bio fertilizers and micronutrients	58	78	62	86
13.	Nitrogen substitution by organics	48	68	62	86
14.	Pre emergence weedicides application	4	16	18	46
15.	Post emergence weedicides application	24	40	30	46
16.	Pest and disease management practices	48	52	54	58
17.	Pest and disease control by chemicals	56	62	62	76
18.	TNAU pulse wonder foliar spray	18	34	68	76
19.	DAP foliar spray	14	34	24	58
20.	Seed treatment for storage	22	30	48	66

Table 2: Overall Knowledge gap index (KGI) of pulse growers in Tiruchirappalli district

KGI Categories (score)	Blackgram					Greengram				
	Knowledge (Observed) score range	No. of pulse growers	Percent	Mean	SD	Knowledge (Observed) score range	No. of pulse growers	Percent	Mean	SD
Low (0-33)	20-38	17	34	24.48	5.15	18-36	11	22	23.6	5.27
Medium (34-66)		33	66				39	78		
High (67-100)		0	0				0	0		
		50	100				50	100		
KGI Categories (score)	**Redgram**					**Horsegram**				
	Knowledge (Observed) score range	**No. of pulse growers**	**Percent**	**Mean**	**SD**	**Knowledge (Observed) score range**	**No. of pulse growers**	**Percent**	**Mean**	**SD**
Low (0-33)	16-32	8	16	22.6	4.34	12-28	7	14	20.6	5.35
Medium (34-66)		42	84				38	76		
High (67-100)		0	0				5	10		
		50	100				50	100		

Table 3: Factors for constraints in adoption of yield maximizing pulse technologies– Garret ranking method

(n=200)

S. No.	Factors	Rank score										Total Score	Total Mean	Order of Rank
		1	2	3	4	5	6	7	8	9	10			
1.	Pest and diseases	151	32	17	0	0	0	0	0	0	0	15693	78.5	I
2.	Poor marketing guidance	102	82	9	7	0	0	0	0	0	0	15077	75.4	II
3.	Lack of technical Know how	104	67	22	7	0	0	0	0	0	0	15010	75.1	III
4.	Low market price/price fluctuation	97	72	31	0	0	0	0	0	0	0	14947	74.7	IV
5.	Exploitation by input dealers /private agencies	85	44	31	28	12	0	0	0	0	0	14251	71.3	V

Impact on Yield and Net returns through yield maximizing technologies in pulses

During the past five years (2016-2021) of taking this study, various interventions like OFTs, FLDs, CFLDs, trainings, seed hub, extension activities *viz.*, farm advisory services, diagnostic visit, group discussion, Kisan Ghosthi, Ilm show, Kisan Mela, exhibition, exposure visits, field days, scientists visit to farmer fields, farmers seminar, method demonstrations, soil health/test campaigns, farmer scientist interaction, awareness campaign, field inspection with department, video documentation, cross learning were executed through Krishi Vigyan Kendra (KVK), Tiruchirappalli for the benefit of the farming community resulted in horizontal spread of 276 ha area in pulses production through promotion of yield maximizing technologies in pulses. The pulses production gradually increased from 126.96 q in 2017-18 to 323.51q in 2020-21 through exclusive NFSM Seed hub at KVK Tiruchirappalli. Highest increase in yield was reported in blackgram (49.15%) and least in redgram (8.74%) with enhanced net returns of Rs.29657 to Rs.7820 respectively mainly due to the adoption high yielding YMV resistant varieties and critical yield maximizing technologies especially TNAU pulse wonder foliar spray which are correlated for its low knowledge gap index. (Table 4).

Table 4: Impact on Yield and Net returns through yield maximizing technologies in pulses among farmers of Tiruchirappalli district (2016-2021)

Pulse crop	Yield (q/ha)		% increase in yield	Net returns (Rs/ha)		Increase in net returns (R/ha)	Benefit Cost Ratio	
	Demo plot	Control plot		Demo plot	Control plot		Demo plot	Control plot
Blackgram	8.77	5.88	49.15	66732.4	37075.4	29657	2.75	2.01
Greengram	10.2	9.1	12.09	18326	15126	3200	2.34	2.11
Redgram	9.74	8.76	8.74	65530	57710	7820	1.58	1.49
Horsegram	4.05	2.95	37.29	14075	7725	6350	2.7	2.1

Conclusion

The study disclosed that high knowledge gap index found for critical yield maximizing technologies *viz.*, amendments for soil surface crusting, soil application of TNAU mineral mixture, foliar spray of KCl and 1% urea, seed coating with bio fertilizers and micronutrients and pest and disease control by chemicals need to be lowered by removing the constraints faced in pulse production through developing mobile apps exclusively for pulse crops and dissemination of yield maximizing technologies jointly with State Department of Agriculture, Non-Governmental Agricultural Organizations, Farmer Producer Organizations (FPO) linkage which in turn increase productivity per unit area and net income in pulses. Seed production in pulses which fetched a higher market price than other crops with lesser capital investment can be upscaled only when the farmers are technically expert in the latest technologies.

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