



Research Article

STUDY ON KNOWLEDGE LEVEL OF WHEAT GROWERS OF INDIA AND AFGHANISTAN REGARDING WHEAT PRODUCTION TECHNOLOGIES

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Abstract: The study was conducted in the states of India and Afghanistan to compare the exiting knowledge of wheat growing farmers on wheat production technologies. Two states from each country were selected for the study purposively representing both the countries for maximum wheat production. These were Punjab and Haryana from India and Herat and Nangarhar from Afghanistan. Hisar (Haryana), Mansa (Punjab) districts from India, Injil (Herat) and Behsood (Nangarhar) districts from Afghanistan were selected for the study. Three villages were selected randomly from each district and thereby a total number of twelve villages were selected for the data collection. 15 wheat growers from each village were selected randomly and total number of 180 wheat growers was selected to constitute a sample of the study. The data were collected through pre-tested structured interview schedule. Twelve important wheat production practices namely; recommended variety, time of sowing, preparation of land, seed rate, spacing, seed treatment, fertilizers, irrigation requirement, roguing, plant protection measure, harvesting/threshing and storage practices were studied for wheat production technology. Weighted mean score of knowledge on various practices in Afghanistan ranged from 1.45 to 2.38. The recommended practices having highest weighted mean score were roguing with rank I, followed by time of sowing with rank II, while weighted mean knowledge score of various practices of wheat production technology in India, ranged from 1.77 to 2.89. Recommended practices having highest weighted mean score were preparation of land with rank I, followed by time of sowing with rank II. Further it was observed that majority of the respondents had low knowledge level about mentioned wheat production technology of wheat in Afghanistan, while in India, majority of the respondents had medium knowledge level of recommended wheat production technology.

Keywords: Knowledge, Production, Technology, Wheat, Weighted mean score, Recommended variety, Time of sowing, Preparation of land

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Introduction

Agriculture is a way of being a tradition that for centuries has shaped the thought, the outlook, the civilization and the economic life of people of India. India's record of growth in agriculture over the past four decades has been fairly impressive. Contribution of agriculture growth to overall progress has been widely extending. Increased productivity has helped to give food to the poor, enhanced farm profits and provided opportunities for both direct and indirect employment. The achievement of India's agriculture is attributed to a sequence of steps that led to the accessibility of farm technologies which brought about a dramatic increase in agricultural development. Future growth needs to be faster, more broadly distributed and better targeted.

Wheat (*Triticum aestivum*) is an important staple food not only in India and Afghanistan but also in almost many developing and developed countries across the globe. It is a cool season crop, widely cultivated under varied agro-ecological conditions and cropping systems throughout the world.

On a global basis, wheat provides better nourishment than any other cereal food crop. The incorporation of dwarf genes in wheat created new varieties that changed the scenario of wheat cultivation all over the world. The semi-dwarf and high-yielding cultivars ushered in the "Green Revolution" by bringing about a phenomenal jump in production and productivity. Efforts to raise the yield level of wheat and finding ways to tackle the impeding factors affecting yield have been a major concern of all quarters. Hybrid wheat cultivars hold some promise for increasing yield and deserve further studies and refinements in the application. Wheat is grown in 218.54 million hectares with a production of 771.71 million tons of grain all over the world [1].

India produces 98.61 million metric tons of wheat from 29.72-million-hectare land with average productivity of 3318 kg/hectare [2] and 75 percent of the wheat produced in India is used for the preparation of chapatti. Like India, wheat is also one of the main cereal crops for Afghan farmers because wheat is a staple food in Afghanistan. In Afghanistan, 1.63-million-hectare area is under wheat cultivation and average production is 2210 kg/hectare and total annual production is 3.61 million metric tons. Afghanistan faces annually around 2.4 million metric tons shortage of wheat which is compensated by importing from other countries [3].

Keeping in view the difference between wheat productivity of India and Afghanistan, this study was undertaken purposively with the specific objective "A Comparative Study on The Knowledge Level of Indian and Afghan Wheat Growers" because the researcher is sponsored by USA under Grain Research and Innovation (GRAIN) project. GRAIN project is exclusively based on increasing wheat production in Afghanistan by different ways and means of wheat production technologies by enhancing the knowledge of wheat growers of Afghan farmers regarding wheat production technologies.

Material and Methods

The study was conducted in Haryana and Punjab states of India and Herat and Nangarhar provinces of Afghanistan purposively. Hisar (Haryana) and Mansa (Punjab) districts from India, Injil (Herat) and Behsood (Nangarhar) districts from Afghanistan were selected purposively because these are among major wheat growing districts in both the countries. Three villages were selected randomly namely; Ramgar, Phuluwala Dogra and Daska from Mansa district and Madha, Daulatpur and Ladwa from Hisar district of India, however Banaghar, Chaharmisr

and Benigah from Behsood district and Naweena-Olia, Qula-e-Faraeha and Sirasiabmukhtar from Injil district of Afghanistan and a total number of twelve villages were selected randomly for the data collection. Fifteen wheat growers were selected randomly from each selected village for interview. Forty-five wheat growers from each state were selected for the study. Thus, a total no of respondents from both the countries (India and Afghanistan) were 180. In the present study the interpretation of recommended variety, time of sowing, preparation of land, seed rate, spacing, seed treatment, fertilizers, irrigation requirement, roguing, plant protection measure, harvesting/threshing and storage practices were analyzed on the basis of wheat production technology to compare their knowledge level. The data were collected with the help of a well-structured and pretested interview schedule comprising the items for assessment of wheat production practices requirements and knowledge level. The wheat production practices were computed with the statistical measures like frequency score, percentages, mean, weighted mean score and ranks to analyze the data to draw the meaning full inferences from the study.

To measure the knowledge level, the farmers were asked to reply different questions on wheat production technology. The obtained scores were placed under three categories on the basis of knowledge they possessed i.e. 'full knowledge' 'partial knowledge' and 'no knowledge' and gave the score 3, 2 and 1 respectively. The obtained scores were then summed up both respondent-wise as well as component-wise. All the components of knowledge were separately categorized into low, medium and high categories of knowledge level to find out overall knowledge level of the respondents.

Result and Discussion

Knowledge level of the respondents about wheat production technology

Overall knowledge of the respondents about wheat production technology It is revealed from [Table-1] that in Afghanistan, 70.00 percent of the respondents had low level of overall knowledge followed by 30.00 percent of them had medium level of overall knowledge and there was no farmer having high overall knowledge about wheat production technology. But in India, 63.33 percent of the respondents had medium level of overall knowledge followed by 23.33 percent of them had high level of overall knowledge and 13.33 percent of them had low level of overall knowledge about wheat production technology.

Achievement of knowledge is the first step in the adoption of any innovation. It is clearly indicating that majority of the respondents were having low level in Afghanistan and majority of the farmers in India, were found to be having medium level of knowledge regarding wheat production technologies.

Similarly, Kumar (2019) [4] reported 61.67 percent of the respondents had medium level of overall knowledge level followed by 25.83 percent of them had high level and 12.50 percent of the respondents had low level of overall knowledge level about wheat seed production technology. While, Patodiya (2018) [5] reported that 61.25 percent of the respondents had medium level of overall knowledge about scientific wheat cultivation practices. This corroborates the above findings of the present study.

Table-1 Distribution of the respondents according to overall knowledge about wheat production technology, (n=180)

SN	Category	Frequency		Percentage	
		Afghanistan	India	Afghanistan	India
1	Low (Below 81)	63	12	70.00	13.33
2	Medium (81 to 105)	27	57	30.00	63.33
3	High (Above 105)	0	21	0.00	23.33
Total		90	90	100.00	100.00

Extent of practice-wise knowledge of wheat production technology by respondents

Land requirement

[Table-2] shows that in Afghanistan, 51.11 percent of the respondents had partial knowledge followed by 26.66 percent had no knowledge and 22.22 percent of them had high level of knowledge about land free from volunteer plants. About location of land, 50.00 percent of the respondents had no knowledge followed by 44.44 percent of them had partial knowledge and only 5.55 percent of the respondents had high level of knowledge about location of land (diseases free

land) of wheat crop. In India, [Table-3] shows that 61.11 percent of the respondents had full knowledge followed by 30.00 percent of them had partial knowledge and 8.88 percent of the respondents had no knowledge of free from volunteer plants land. About location of land, two-third of the respondents (63.33%) had full knowledge followed by 28.88 percent of them had partial knowledge and 7.77 percent of the respondents had no knowledge about location of land (diseases free land) in wheat crop. It is clear from above findings that in Afghanistan, more than half of the respondents had partial knowledge, while in India, majority of the respondents had full knowledge for land requirement in wheat crop. Similarly, Kumar (2019) [4] had reported that 62.50 percent of the wheat growers had full knowledge of land selection.

Recommended varieties

It is shown in [Table-2] that in Afghanistan, 56.66 percent of the respondents had partial knowledge followed by 23.33 percent had full knowledge and one-fifth of the respondents (20.00%) had no knowledge about recommended varieties of wheat. Although in India, [Table-3] shows that 60.00 percent of the respondents had full knowledge followed by 35.55 percent of them had partial knowledge and only 4.44 percent had no knowledge of recommended varieties of wheat crop. The above findings clearly indicate that Afghan wheat growers are having less knowledge about recommended varieties of wheat crop than Indian wheat growers.

Time of sowing

The sowing time was categorized into two parts viz., early sowing (First fortnight of November) and late sowing (December). It was found that in Afghanistan [Table-2], half of the respondents (51.11%) had partial knowledge followed by 44.44 percent had full knowledge and only 4.44 percent of the respondents had no knowledge of early sowing of wheat crop. About late sowing (December), 60.00 percent of the respondents had partial knowledge followed by 32.22 percent of the respondents had full knowledge and 7.77 percent of the respondents had no knowledge about late sowing of wheat crop. But in India [Table-3], majority of the respondents (88.88%) had full knowledge followed by 10.00 percent of the respondents had partial knowledge and only 1.11 percent of them had no knowledge of early sowing time of wheat crop. Great majority of the respondents (85.55%) had full knowledge followed by 11.11 percent of them had partial knowledge and only 3.33 percent of the respondents had no knowledge about late sowing of wheat crop. The study shows a big difference of knowledge about time of sowing in wheat crop between Afghan and Indian wheat growers. Similarly, Rajbhar *et al.* (2017) [6] reported that 97.90 percent of wheat growers had knowledge of sowing time of wheat crop.

Preparation of land

The preparation of land was categorized into two sub-categories viz., deep ploughing with soil turning plough followed by two harrowing and planking and land leveling. It was found that in Afghanistan [Table-2], half of the respondents (51.11%) had no knowledge followed by 41.11 percent of them had partial knowledge and 7.77 percent of the respondents had full knowledge about deep ploughing with soil turning plough followed by two harrowing and planking in wheat crop. 74.44 percent of wheat growers had partial knowledge followed by 17.77 percent of them had full knowledge and 7.77 percent of the respondents had no knowledge about land leveling for seed bed. But in India [Table-3], majority of the respondents (87.77%) had full knowledge followed by 11.11 percent of the respondents had partial knowledge and only 1.11 percent of the respondents had no knowledge about deep ploughing with soil turning plough followed by two harrowing and planking in wheat field. About land leveling, great majority of the wheat growers (93.33%) had full knowledge followed by 5.55 percent of them had partial knowledge and only 1.11 percent of them had no knowledge about land leveling for seed bed in wheat crop.

Seed rate

The data presented in [Table-2] depicts the knowledge regarding seed rate for early/timely sowing (100kg/hectare) in Afghanistan. Great majority of the

Table-2 Extent of practice-wise knowledge of wheat production technology by Afghan wheat growers (n=90)

SN	Category	Level of knowledge						
		Full Knowledge		Partial Knowledge		No Knowledge		
		F	%	F	%	F	%	
A.	Land requirement							
1.	Free from volunteer plants	20	22.22	46	51.11	24	26.66	
2.	Location of land (Diseases free land)	5	5.55	40	44.44	45	50.00	
B.	Recommended Varieties	21	23.33	51	56.66	18	20.00	
C.	Time of sowing							
1.	Early sown (First fortnight of November)	40	44.44	46	51.11	4	4.44	
2.	Late sown (December)	29	32.22	54	60.00	7	7.77	
D.	Preparation of land							
1.	Deep plugging with soil turning plough followed by two harrowing and planking	7	7.77	37	41.11	46	51.11	
2.	Leveling for seed bed	16	17.77	67	74.44	7	7.77	
E.	Seed rate (kg/hectare)							
1.	Early /timely sown - 100 kg	1	1.11	6	6.66	83	92.22	
2.	Late sown -125 kg	2	2.22	4	4.44	84	93.33	
F.	Spacing							
1.	Irrigated timely sown (20 cm)	1	1.11	5	5.55	84	93.33	
2.	Irrigated late sown (18 cm)	0	0.00	2	2.22	88	97.77	
G.	Seed treatment	6	6.66	33	36.66	51	56.66	
H.	Fertilizers							
1.	Nitrogen (375 kg/hectare)	34	37.77	53	58.88	3	3.33	
2.	Phosphorous (150 kg/hectare)	45	50.00	35	38.88	10	11.11	
3.	Potash (100 kg/hectare)	6	6.66	1	1.11	83	92.22	
I.	Irrigation Requirement							
1.	Crown root initiation stage (20-25 DAS)	54	60.00	18	20.00	18	20.00	
2.	Tillering stage (40-45 DAS)	38	42.22	29	32.22	23	25.55	
3.	Jointing stage (60-65 DAS)	30	33.33	36	40.00	24	26.66	
4.	Flowering stage (80-85 DAS)	30	33.33	40	44.44	20	22.22	
5.	Milking stage (100-105 DAS)	15	16.66	43	47.77	32	35.55	
6.	Dough stage (115-120 DAS)	10	11.11	46	51.11	34	37.77	
J.	Roguing (Off type, diseased, weed &other variety plants)							
1.	Vegetative stage (No. of days if any)	30	33.33	44	48.88	16	17.77	
2.	Flowering stage	2	2.22	28	31.11	60	66.66	
3.	Maturity stage	1	1.11	20	22.22	69	76.66	
K.	Plant protection measures							
1.	Chemical control of insect – pest							
	Name of insect –pest	Control measures						
i.	Termite	5ltr Chloropyriphos 20EC with 5 ltr. water in 50 kg sand per hectare	1	1.11	28	31.11	61	67.77
ii.	Aphid-jassids	Use 1000 ml Malathion 50EC in 625 ltr. water per hectare	4	4.44	27	30.00	59	65.55
2.	Chemical disease control							
	Name of diseases	Control measures						
i.	Loose smut	Seed treatment with 2 gm Vitavax or Bavistin or 1gm Raxil per kg seed	2	2.22	34	37.77	54	60.00
ii.	Flag smut	Seed treatment with 2 gm Vitavax or Bavistin per kg seed	2	2.22	23	25.55	65	72.22
iii.	Powdery mildew	Spray 2litre Kara thane or Sulfex in 625 ltr. water per hectare	0	0.00	32	35.55	58	64.44
iv.	Rust	Yellow rust-Spray 500 ml Propacona-zole Brown rust - Spray 2litre Mancozeb 625 ltr. water/ hectare	23	25.55	48	53.33	19	21.11
v.	Kamal bunt	Seed treatment with 2 gm Thiram per kg seed	0	0.00	10	11.11	80	88.88
3.	Chemical weed control							
	Name of weed	Control measures						
i.	Broad leaf weed	Spray 625 g 2, 4-D or 20 g Metsulfuron or 50 gm Affinity in 625 ltr. of water per hectare	18	20.00	56	62.22	16	17.77
ii.	Grassyweeds (<i>Phalarisminor</i> & <i>wild oat</i>)	Spray 400 gm Topik or 32 gm Leader or 1000 ml Axial in 625 ltr. of water per hectare	18	20.00	56	62.22	16	17.77
iii.	Broad leaf weed+Grassy leaf weeds	Spray 40 gm Total or 400 gm Atlantis or 400gm Vesta in 625 ltr. water per hectare	18	20.00	55	61.11	17	18.88
L.	Harvesting/ threshing							
1.	Harvesting at proper stage (moisture content)		0	0.00	4	4.44	86	95.55
2.	Cleanliness of equipment (thresher, Combine)		0	0.00	23	25.55	67	74.44
3.	Different varieties threshed separately		14	15.55	64	71.11	12	13.33
M.	Storage							
1.	Moisture at the time of storage		0	0.00	2	2.22	88	97.77
2.	Type of storage structure: (a) Air tight room (b) Steel storage bins (c) Silos (d) Others		3	3.33	56	62.22	31	34.44
3.	For seed purpose/grain purpose		2	2.22	58	64.44	30	33.33

Table-3 Extent of practice-wise knowledge of wheat production technology by Indian wheat growers, (n=90)

SN	Particulars	Level of knowledge					
		Full Knowledge		Partial Knowledge		No Knowledge	
		F	%	F	%	F	%
A.	Land requirement						
1.	Free from volunteer plants	55	61.11	27	30.00	8	8.88
2.	Location of land (Diseases free land)	57	63.33	26	28.88	7	7.77
B.	Recommended Varieties	54	60.00	32	35.55	4	4.44
C.	Time of sowing						
1.	Early sown (First fortnight of November)	80	88.88	9	10.00	1	1.11
2.	Late sown (December)	77	85.55	10	11.11	3	3.33
D.	Preparation of land						
1.	Deep plugging with soil turning plough followed by two harrowing and planking	79	87.77	10	11.11	1	1.11
2.	Leveling for seed bed	84	93.33	5	5.55	1	1.11
E.	Seed rate (kg/hectare)						
1.	Early /timely sown - 100 kg	80	88.88	9	10.00	1	1.11
2.	Late sown -125 kg	80	88.88	8	8.88	2	2.22
F.	Spacing						
1.	Irrigated timely sown (20 cm)	32	35.55	42	46.66	16	17.77
2.	Irrigated late sown (18 cm)	30	33.33	44	48.88	16	17.77
G.	Seed treatment	30	33.33	33	36.66	27	30.00
H.	Fertilizers						
1.	Nitrogen (375 kg/hectare)	64	71.11	25	27.77	1	1.11
2.	Phosphorous (150 kg/hectare)	69	76.66	20	22.22	1	1.11
3.	Potash (100 kg/hectare)	35	38.88	26	28.88	29	32.22
I.	Irrigation Requirement						
1.	Crown root initiation stage (20-25 DAS)	60	66.66	25	27.77	5	5.55
2.	Tillering stage (40-45 DAS)	54	60.00	30	33.33	6	6.66
3.	Jointing stage (60-65 DAS)	30	33.33	48	53.33	12	13.33
4.	Flowering stage (80-85 DAS)	27	30.00	45	50.00	18	20.00
5.	Milking stage (100-105 DAS)	25	27.77	45	50.00	20	22.22
6.	Dough stage (115-120 DAS)	23	25.55	42	46.66	25	27.77
J.	Roguing (Off type, diseased, weed & other variety plants)						
1.	Vegetative stage (No. of days if any)	56	62.22	26	28.88	8	8.88
2.	Flowering stage	17	18.88	39	43.33	34	37.77
3.	Maturity stage	17	18.88	40	44.44	33	36.66
K.	Plant protection measures						
1.	Chemical control of insect – pest						
	Name of insect –pest	Control measures					
i.	Termite	5ltr Chloropyriphos 20EC with 5 ltr. water in 50 kg sand per hectare		22	24.44	31	34.44
ii.	Aphid-jassids	Use 1000 ml Malathion 50EC in 625 ltr. water per hectare		22	24.44	32	35.55
2.	Chemical disease control						
	Name of diseases	Control measures					
i.	Loose smut	Seed treatment with 2 gm Vitavax or Bavistin or 1gm Raxil per kg seed		15	16.66	25	27.77
ii.	Flag smut	Seed treatment with 2 gm Vitavax or Bavistin per kg seed		12	13.33	26	28.88
iii.	Powdery mildew	Spray 2litre Kara thane or Sulfex in 625 ltr. water per hectare		24	26.66	45	50.00
iv.	Rust	Yellow rust-Spray 500 ml Propacona-zole Brown rust -Spray 2litre Mancozeb 625 ltr. water/ hectare		41	45.55	36	40.00
v.	Karnal bunt	Seed treatment with 2 gm Thiram per kg seed		13	14.44	23	25.55
3.	Chemical weed control						
	Name of weed	Control measures					
i.	Broad leaf weed	Spray 625 g 2, 4-D or 20 g Metsulfuron or 50 gm Affinity in 625 ltr. of water per hectare		32	35.55	38	42.22
ii.	Grassy weeds (<i>Phalaris minor</i> & wild oat)	Spray 400 gm Topik or 32 gm Leader or 1000 ml Axial in 625 ltr. of water per hectare		35	38.88	37	41.11
iii.	Broad leaf weed+Grassy leaf weeds	Spray 40 gm Total or 400 gm Atlantis or 400gm Vesta in 625 ltr. water per hectare		31	34.44	27	30.00
L.	Harvesting/ threshing						
1.	Harvesting at proper stage (moisture content)	56	62.22	18	20.00	16	17.77
2.	Cleanliness of equipment (thresher, Combine)	17	18.88	17	18.88	56	62.22
3.	Different varieties threshed separately	83	92.22	4	4.44	3	3.33
M.	Storage						
1.	Moisture at the time of storage	30	33.33	25	27.77	35	38.88
2.	Type of storage structure: (a) Air tight room (b) Steel storage bins (c) Silos (d) Others	38	42.22	47	52.22	5	5.55
3.	For seed purpose/grain purpose	47	52.22	38	42.22	5	5.55

respondents (92.22%) had no knowledge followed by 6.66 percent of them had partial knowledge and 1.11 percent of the respondents had full knowledge about early/timely sowing of wheat crop. For late sowing (125 kg/hectare), great majority

of the respondents (93.33%) had no knowledge followed by 4.44 percent of them had partial knowledge and only 2.22 percent of the respondents had full knowledge.

On the contrary in India, the data in [Table-3] shows that majority of the respondents (88.88%) had full knowledge followed by 10.00 percent of them had partial knowledge and only 1.11 percent of the respondents had no knowledge about early/timely sowing of wheat crop. For late sowing (125 kg/hectare), great majority of the respondents (88.88%) had full knowledge followed by 8.88 percent of them had partial knowledge and only 2.22 percent of the respondents had no knowledge about late sowing of wheat crop. Similarly, Rajbhar *et al.* (2017) [6] reported that 95.45 percent of wheat growers had knowledge of recommended seed rate in wheat crop.

Spacing

The data in [Table-2] shows that in Afghanistan, 93.33 percent of the respondents had no knowledge followed by 5.55 percent of them had partial knowledge and only 1.11 percent of them had full knowledge about timely irrigated sowing of wheat crop. About irrigated late sowing (18 cm), great majority of the respondents (97.77%) had no knowledge followed by 2.22 percent of them had partial knowledge and none of the farmers answered for full knowledge about irrigated late sown of wheat.

But in India [Table-3], 46.66 percent of the respondents had partial knowledge followed by 35.55 percent of the respondents had full knowledge and 17.77 percent of the respondents had no knowledge about timely irrigated sowing (20 cm) spacing in wheat crop. For irrigated late sown, 48.88 percent of the respondents had partial knowledge followed by one-third of the respondents (33.33%) had full knowledge and 17.77 percent of the respondents had no knowledge about late sowing (18 cm) of wheat crop. From the above findings, it can be said that in Afghanistan, almost all of the wheat growers were not sowing wheat crop with proper spacing and spacing is one of the important key factors in maintaining proper plant population for optimum yield of wheat crop.

Seed treatment

The results in [Table-2] shows that in Afghanistan, 56.66 percent of the respondents had no knowledge, while more than one-third of them (36.66%) had partial knowledge and 6.66 percent of them had full knowledge about seed treatment in wheat crop. In India, [Table-3], 36.66 percent of the respondents had partial knowledge followed by 33.33 percent of the respondents had full knowledge and 30.00 percent of the respondents had no knowledge about wheat seed treatment in wheat crop.

Fertilizer

The data presented in [Table-2] shows that in Afghanistan, 58.88 percent of the respondents had partial knowledge followed by 37.77 percent of the respondents had full knowledge and only 3.33 percent of them had no knowledge about recommended dose of nitrogen (375 kg/hectare) application in wheat crop. Half of the respondents (50.00%) had full knowledge followed by 38.88 percent of them had partial knowledge and 11.11 percent of the respondents had no knowledge about recommended dose of phosphorous (150 kg/hectare) application in wheat crop. Great majority of the respondents (92.22%) had no knowledge followed by 6.66 percent had full knowledge and only 1.11 % of the respondents had partial knowledge about recommended dose of potash (100 kg/hectare) in wheat crop.

In India, the [Table-3] shows that 71.11 percent of the respondents had full knowledge followed by 27.77 percent of them had partial knowledge and 1.11 percent of the respondents had no knowledge about recommended dose of nitrogen (375 kg/hectare) application in wheat crop. 76.66 percent of the respondents had full knowledge followed by 22.22 percent of them had partial knowledge and only 1.11 percent of the respondents had no knowledge about recommended dose of phosphorous (150 kg/hectare) in wheat crop. 38.88 percent of the respondents had full knowledge followed by 32.22 percent of the respondents had no knowledge and 28.88 percent of the respondents had partial knowledge about recommended dose of potash (100 kg/hectare) application in wheat crop.

Similarly, Kumar (2019) [4] reported that 78.33 percent of the respondents had full knowledge about recommended dose of urea in wheat crop followed by 21.67 percent of the respondents had partial knowledge. Almost all of the respondents

(95.83%) had full knowledge about recommended dose of Di-ammonium phosphate (DAP) in wheat crop followed by only 4.17 percent of the respondents had partial knowledge. 55.83 percent had full knowledge about recommended dose of murate of potash in wheat crop followed by 28.33 percent of them had partial knowledge and 15.83 percent of the respondents had no knowledge.

Irrigation requirement

As for as significance of irrigation is concerned, the study shows that in Afghanistan [Table-2], about crown root initiation stage (20-25 DAS), 60.00 percent of the respondents had full knowledge, 20.00 percent of the respondents had partial and 20.00 percent had no knowledge. 42.22 percent of the respondents had full knowledge followed by 32.22 percent of the respondents had partial knowledge and 25.55 percent of the respondents had no knowledge about tillering stage of irrigation (40-45 DAS) in wheat crop. 40.00 percent of the respondents had partial knowledge followed by 33.33 percent of them had full knowledge and 26.66 percent of the respondents had no knowledge about jointing stage of irrigation (60-65 DAS) in wheat crop. 44.44 of the respondents had partial knowledge followed by 33.33 percent of the respondents had full knowledge and 22.22 percent of the respondents had no knowledge about flowering stage of irrigation (80-85 DAS) in wheat crop. 47.77 percent of the respondents had partial knowledge followed by 35.55 percent of the respondents had no knowledge and 16.66 percent of the respondents had full knowledge about milking stage of irrigation (100-105 DAS) in wheat crop. 51.11 percent of the respondents had partial knowledge followed by 37.77 percent of the respondents had no knowledge and 11.11 percent of the respondents had full knowledge about dough stage of irrigation (115-120 DAS) in wheat crop.

While in India, [Table-3] shows that about irrigation at crown root initiation stage, 66.66 percent of the respondents had full knowledge followed by 27.77 percent of them had partial knowledge and 5.55 percent of the respondents had no knowledge. About tillering stage, 60.00 percent of the respondents had full knowledge followed by 33.33 percent of them had partial knowledge and 6.66 percent of the respondents had no knowledge. 53.33 percent of the respondents had partial knowledge followed by 33.33 percent of them had full knowledge and 13.33 percent of the respondents had no knowledge about jointing stage of irrigation application in wheat crop. 50.00 percent of the respondents had partial knowledge followed by 30.00 percent of them had full knowledge and one-fifth of the respondents (20.00%) had no knowledge about flowering stage of irrigation application in wheat crop. 50.00 percent of the respondents had partial knowledge followed by 27.77 percent of them had full knowledge and 22.22 percent of the respondents had no knowledge about milking stage of irrigation application in wheat crop. 46.66 percent of the respondents had partial knowledge followed by 27.77 percent of them had no knowledge and 25.55 percent of the respondents had full knowledge about dough stage of irrigation application in wheat crop.

Roquing

It was observed from the study that in Afghanistan [Table-2], 48.88 percent respondents had partial knowledge followed by 33.33 percent had full knowledge and 17.77 percent of the respondents had no knowledge about roquing at pre-flowering stage. About roquing at flowering stage, 66.66 percent of the respondents had no knowledge followed by 31.11 percent of the respondents had partial knowledge and only 2.22 percent of the respondents had full knowledge. Whereas, 76.66 percent of the respondents had no knowledge followed by 22.22 percent of them had partial knowledge and only 1.11 percent of the respondents had full knowledge about roquing at maturity stage in wheat crop.

In India [Table-3], 62.22 percent of the respondents had full knowledge followed by 28.88 percent of them had partial knowledge and 8.88 percent of the respondents had no knowledge about roquing at pre-flowering stage. About roquing at flowering stage, 43.33 percent of the respondents had partial knowledge followed by 37.77 percent of them had no knowledge and 18.88 percent of the respondent had full knowledge. 44.44 percent of the respondents had partial knowledge followed by 36.66 percent of them had no knowledge and 18.88 percent of the respondents had full knowledge about roquing at maturity stage in wheat crop.

Similarly, Kumar (2019) [4] studied that more than half of the respondents (53.33%) had full knowledge followed by 46.67 percent of the respondents had no knowledge about roguing at pre-flowering stage. Majority of the respondents (86.67%) had full knowledge followed by 13.33 percent of the respondents had no knowledge about roguing at flowering stage. Whereas, all of the respondents (100.00%) had full knowledge about roguing at maturity stage.

Plant protection measures

The plant protection measures were categorized into three sub-headings viz. chemical insect-pest control, chemical disease control and chemical weed control. Under the first category, only two main insect-pests which were reported to be responsible for causing damage to wheat crop i.e. termite and aphids-jassids. The data presented in [Table-2] shows that in Afghanistan, 67.77 and 65.55 percent of the respondents had no knowledge followed by 31.11 and 30.00 percent of them had partial knowledge and 1.11 percent and 4.44 percent of the respondents had no knowledge about chemical insect-pest control of termite and aphid-jassids respectively in wheat crop.

As far as diseases of wheat crop are concerned, there were five main diseases reported to be responsible for causing damage to wheat crop. In Afghanistan, with regards to chemical control of loose smut disease, 60.00 percent of the respondents had no knowledge followed by 37.77 percent of them had partial knowledge and only 2.22 percent of the respondents had no knowledge. About flag smut, 72.22 percent of the wheat growers had no knowledge followed by 25.55 percent of them had partial knowledge and only 2.22 percent of the respondents had full knowledge. 64.44 percent of the respondents had no knowledge followed by 35.55 percent of them had partial knowledge about chemical control of powdery mildew in wheat crop.

About half of wheat growers (53.33%) had partial knowledge followed by 25.55 percent of them had full knowledge and 21.11 percent of the respondents had no knowledge about chemical control of rust in wheat crop. It was observed that great majority of the respondents (88.88%) had no knowledge followed by 11.11 percent of them had partial knowledge about chemical control of Karnal bunt in wheat crop.

With regards to chemical weed control, majority of the respondents in Afghanistan (62.22%) had partial knowledge followed by 20.00 percent of them had full knowledge and 17.77 percent of the respondents had no knowledge about chemical control of broad leaf weeds in wheat crop. 62.22 percent of the respondents had partial knowledge followed by 20.00 percent of them had full knowledge and 17.77 percent of the respondents had no knowledge about chemical control of grassy weeds (*Phalaris minor* and wild oat).

However, 61.11 percent of the respondents had partial knowledge followed by 20.00 percent of them had full knowledge and 18.88 percent of the respondents had no knowledge about chemical control of both broad leaf weeds and grassy weeds in wheat crop.

In India, data in [Table-3] shows that 41.11 and 40.00 percent of wheat growers had no knowledge followed by 34.44 and 35.55 percent of them had partial knowledge and 24.44 percent of the respondents had full knowledge about chemical control of termite and aphid-jassids respectively in wheat crop.

About diseases of wheat crop are concerned, 55.55 percent of the respondents had no knowledge followed by 27.77 percent of the respondents had partial knowledge and 16.66 percent of them had full knowledge for chemical control of loose smut in wheat crop.

About chemical control of flag smut, 57.77 percent of the respondents had no knowledge followed by 28.88 percent of them had partial knowledge and 13.33 percent of the respondents had full knowledge in wheat crop. 50.00 percent of the respondents had partial knowledge followed by 26.66 percent of them had full knowledge and 23.33 percent of the respondents had no knowledge about chemical control of powdery mildew in wheat crop. 45.55 percent of the wheat growers had full knowledge followed by 40.00 percent of them had partial knowledge and 14.44 percent of the respondents had no knowledge about chemical control of rust in wheat crop.

It was also observed that 60.00 percent of the respondents had no knowledge followed by 25.55 percent of them had partial knowledge and 14.44 percent of

them had full knowledge of chemical control of Karnal bunt disease in wheat crop. However, Rajbhar *et al.* (2017) [6] reported that 82.87 percent of wheat growers had medium knowledge about insect-pests and diseases management.

About chemical control of weeds, 42.22 percent of the respondents had partial knowledge followed by 35.55 percent of them had full knowledge and 22.22 percent of the respondents had no knowledge. Whereas, 41.11 percent of the respondents had partial knowledge followed by 38.88 percent of them had full knowledge and 20.00 percent of the respondents had no knowledge about chemical control of grassy weeds (*Phalaris minor* and wild oat) in wheat crop. However, more than one-third (35.55%) of the respondents had no knowledge followed by 34.44 percent of them had full knowledge and 30.00 percent of the respondents had partial knowledge of chemical control of both broad leaf and grassy weeds in wheat crop.

Harvesting and threshing

The suggested harvesting practices for wheat production included, harvesting at proper (moisture content) stage, cleanliness of equipment's and threshing of different varieties separately. In Afghanistan [Table-2], it was found that as high as of the respondents (95.55%) had no knowledge followed by 4.44 percent of them had partial knowledge and none of the respondents answered for full knowledge about harvesting of wheat crop at proper stage. For cleanliness of equipment, 74.44 percent of the respondents had no knowledge followed by 25.55 percent of the respondents had partial knowledge and none of the respondents answered for full knowledge about cleanliness of equipment. 71.11 percent of the respondents had partial knowledge followed by 15.55 percent of them had full knowledge and 13.33 percent of the respondents had no knowledge about threshing of different varieties of wheat crop separately.

While in India [Table-3], it was found that 62.22 percent of the respondents had full knowledge followed by 20.00 percent of them had partial knowledge and 17.77 percent of the respondents had no knowledge about harvesting of wheat crop at proper stage (moisture content). For cleanliness of equipment, 62.22 percent of the respondents had no knowledge followed by 18.88 percent each of them had partial and full knowledge about cleanliness of equipment's. Great majority of the respondents (92.22%) had full knowledge followed by 4.44 percent of them had partial knowledge and 3.33 percent of them had no knowledge about threshing of different varieties of wheat crop separately.

Similarly, Kumar (2019) [4] reported that all the respondents had full knowledge about harvesting of wheat at maturity stage. Moreover, 97.50 percent of the respondents had full knowledge followed by only 2.50 percent of the respondents had no knowledge about cleanliness of equipment. A huge majority of the respondents (93.33%) had full knowledge followed by only 6.67 percent of the respondents who had no knowledge about different varieties threshed separately.

Storage

The recommended practices for wheat storage included, moisture at the time of storage, type of storage structure and storage for seed and grain purpose. In Afghanistan [Table-2], it was found that 97.77 percent of the respondent had no knowledge, 2.22 percent of them had partial knowledge and none of the respondents had full knowledge about moisture at the time of wheat storage. About type of storage structure, 62.22 percent of the respondents had partial knowledge followed by 34.44 percent of them had no knowledge and only 3.33 percent of the respondents had full knowledge. Storage for seed and grain purpose, 64.44 percent of the respondents had partial knowledge followed by 33.33 percent of them had no knowledge and only 2.22 percent of the respondents had full knowledge.

While in India [Table-3], it was found that 38.88 percent of the respondents had no knowledge followed by 33.33 percent of them had full and 27.77 percent of the respondents had partial knowledge about moisture at the time of storage. 52.22 percent of the respondents had partial knowledge followed by 42.22 percent had full knowledge and only 5.55 percent of them had no knowledge about type of wheat storage structure. 52.22 percent of the respondents had full knowledge followed by 42.22 percent of them had partial knowledge and only 5.55 percent had no knowledge about storage of seed and grain purpose of wheat.

Respondents' knowledge weighted mean score of various practices of wheat production technology

The study is revealed that respondent's knowledge mean score of various practices of wheat production technology for Afghanistan ranged from 1.45 to 2.38 [Table-4]. Further, the optional practice having highest mean score was roguing ranked I followed by time of sowing ranked II, whereas, irrigation requirement, recommended varieties, fertilizers, seed rate, preparation of land, land requirement, plant protection measures, spacing, seed treatment, storage and harvesting /threshing were ranked III, IV, V, VI, VII, VIII, IX, X, X, XI and XII, respectively.

Table-4 Respondents' knowledge weighted mean score of various practices of wheat production technology by Afghan farmers, (n=90)

SN	Particulars	Weighted mean score	Rank order
1	Land requirement	1.76	VIII
2	Recommended varieties	2.03	IV
3	Time of sowing	2.32	II
4	Preparation of land	1.83	VII
5	Seed rate (kg/acre)	1.84	VI
6	Spacing	1.50	X
7	Seed treatment	1.50	X
8	Fertilizers	1.96	V
9	Irrigation requirement	2.05	III
10	Roguing	2.38	I
11	Plant protection measurement	1.60	IX
12	Harvesting thrashing	1.45	XII
13	Storage	1.47	XI

Thus, it was concluded that roguing and time of sowing were very recognised practices by Afghan wheat growers than other practices, while harvesting/threshing, seed treatment and spacing need much attention to enrich Afghan wheat grower's knowledge regarding wheat production technology.

In India, in comparison to Afghanistan, knowledge weighted mean score of various practices of wheat production technology, ranged from 1.77 to 2.89 [Table-5]. The optional practice having highest mean score was preparation of land and it was ranked I followed by time of sowing ranked II, whereas, recommended varieties, land requirement, fertilizers, harvesting thrashing, storage, irrigation requirement, roguing, seed treatment, seed rate, plant protection measures spacing were ranked III, IV, V, VI, VII, VIII, IX, X, X, XI and XII, respectively.

Thus, it was concluded that preparation of land and time of sowing were very recognized practices by Indian wheat growers than other practices. While, spacing, plant protection measurements and seed rate need more attention to Indian wheat growers' knowledge regarding wheat production technology.

Table-5 Respondents' knowledge weighted mean score of various practices of wheat production technology by Indian farmers (n=90)

SN	Particulars	Weighted mean score (1-3)	Rank order
1	Land requirement	2.54	IV
2	Recommended varieties	2.56	III
3	Time of sowing	2.75	II
4	Preparation of land	2.89	I
5	Seed rate (kg/hectare)	2.03	X
6	Spacing	1.77	XII
7	Seed treatment	2.03	X
8	Fertilizers	2.51	V
9	Irrigation requirement	2.25	VIII
10	Roguing	2.06	IX
11	Plant protection measurement	1.90	XI
12	Harvesting thrashing	2.30	VI
13	Storage	2.26	VII

Conclusion

The majority of the respondents (70.00%) in Afghanistan had low level of overall knowledge followed by 30.00 percent had medium level of overall knowledge, while In India, majority of the respondents (63.33%) had medium level knowledge followed by 23.33 percent of them had high and 13.33 percent of the respondents had low level knowledge of wheat production technology in wheat crop. Further, Afghan farmers' knowledge weighted mean score of various practices of wheat production technology ranged from 1.45 to 2.38. The recommended practices having highest mean score were roguing with rank I followed by time of sowing

with rank II, whereas, Indian farmers' knowledge weighted mean score of various practices of wheat production technology ranged from 1.77 to 2.2.89. Recommended practices having highest mean score were preparation of land with rank I followed by time of sowing with rank II. It is clearly indicating that Afghan farmers are far behind Indian farmers in knowledge of various wheat production technologies. So, it needs much attention of Afghan government to formulate such policies for researchers, extension functionaries and other agencies which are working directly or indirectly with the Afghan farmers for boosting the wheat production in Afghanistan by applying various wheat production technologies. All stakeholders should be well equipped with all production technologies and inputs in terms of knowledge through latest media tools, improved seeds, fertilizers, pesticides and other natural resource management practices such as drip, sprinkler, bed planting methods of irrigation and other ways and means of transferring latest wheat production technologies among the Afghan farmers.

Application of research: Enhancement of wheat production and productivity by formulating proper extension strategy to fill the adoption gaps and addressal of constraints encountered by wheat growers of India and Afghanistan.

Research Category: Extension Education

Abbreviations: APR-Agriculture Progress Report, DAS-Days After Sowing, FAO-Food and Agriculture Organization, GRAIN-Grain Research and Innovation MAIL-Ministry of Agriculture, Irrigation and Livestock

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Cultivar / Variety / Breed name: Wheat Crop

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