Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 1240-1244
Received: 04-11-2020
Accepted: 06-12-2020

Rupesh Kumar Meena
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Bhupender Singh
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Seema Chawla
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Ravi Kumar Meena
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Kuladip Prakash Shinde
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Corresponding Author:
Rupesh Kumar Meena
Krishi Vigyan Kendra, Padampur, Sri Ganganagar SK Rajasthan Agricultural University, Bikaner, Rajasthan, India

Evaluation of frontline demonstrations of chickpea under irrigated North Western Plain Zone-1b of Rajasthan

Rupesh Kumar Meena, Bhupender Singh, Seema Chawla, Ravi Kumar Meena and Kuladip Prakash Shinde

Abstract
Krishi Vigyan Kendra, Sri Ganganagar (Rajasthan) conducted 250 frontline demonstrations on chickpea variety GNG-1958 (Marudhar) over an area of 100 hectares during *rabi* season of 2017-18, 2018-19 and 2019-20. The results of the demonstrations revealed that on an average seed yield of chickpea under improved technology ranged from 17.85 to 19.57 q/ha with a mean of 18.52 q/ha which was 15.33 per cent more yield as compared to local check. Moreover, the seed yield also recorded substantially higher under demonstration (18.52 q/ha) over district average (11.73 q/ha) and state average (11.02 q/ha). Further, findings of the study revealed that from one hectare average additional yield 2.57 q/ha, net monetary return ₹47565/ha, additional returns ₹10404/ha, effective gain ₹8289/ha and benefit: cost ratio 2.65 were obtained under improved technology as compared to farmers' practice. The average technology gap (5.48 q/ha), extension gap (2.57q/ha) and technology index (22.82%) were found.

Keywords: Frontline demonstrations, chickpea, economics, yield gap and farmer's practice

Introduction
Chickpea or gram (*Cicer arietinum* L.) is a major *rabi* pulse crop has cheap source of about 18-22% protein, 62% carbohydrate, fat and good quality lysine, tryptophan etc. It is a soil building crop and being a leguminous crop, it fixes atmospheric nitrogen through symbiotic fixation, there by helps in N cycling within the ecosystem. India contributes as a largest chickpea producer as well as consumer in the world. In India, chickpea mainly grown in states of Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat, Karnataka, Haryana, Bihar and West Bengal. In India, chickpea covers an acreage of 9.44 mha contributing 10.13 mt of production with an average productivity of 10.73 q/ha during 2018-19 (Anonymous, 2019) [1, 2]. In Rajasthan, chickpea is grown in area of 1.59 million hectare with an average production of 1.83 mt and productivity of 11.52 qt/ha (Anonymous, 2019) [1, 2]. Whereas, demonstrations district under study *viz.* Sri Ganganagar covers total production of gram was 88269 tonnes from the area of 73080 hectare with productivity of 12.08 q/ha. (Anonymous, 2018) [1, 2]. It clearly indicate that average productivity of chickpea (12.08 q/ha) in Sriganganagar district is comparatively higher than the state average yield (11.52 q/ha). However, still it is low as compared to production potential of the demonstrated variety GNG-1958 (24.0 q/ha). Severe biotic and abiotic stress and partial follow of recommended improved production technology of chickpea is major reason for lower in productivity of chickpea. The productivity of chickpea can be further enhanced by adopting improved high yielding varieties and scientific crop management practices (Kumar R., 2014) [4, 6].

Indian government imports large quantity of pulses to fulfill the domestic requirement of pulses. In this regard, to sustain this production and consumption system, Government of India has initiated frontline demonstrations (FLDs) under National Food Security Mission. Frontline demonstration is the method of field demonstration evolved by the ICAR with the inception of Technology Mission on Oilseed crop. The frontline demonstration is also an important method of extension to transfer of latest package of practices in totality to farmers, because farmers in general, are driven by the perception that "Seeing is believing. The main aim of this programme is to demonstrate latest crop production and protection technologies and crop management practices at the farmers' field under different agro-climatic zones and real farming situation under the supervision of Agricultural scientists. Through this practice, scientist identified the newly improved innovative technology, factors and field constraints of higher production and simultaneously feedback from the farmers may be generated on the demonstrated technology.

In view, to evaluate the effectiveness of frontline demonstrations, Krishi Vigyan Kendra, Sri Ganganagar conducted cluster frontline demonstrations on chickpea crop in participatory mode in different selected villages of Sri Ganganagar district.

Methodology
Cluster frontline demonstrations of chickpea were carried out by Krishi Vigyan Kendra, Sri Ganganagar (Rajasthan) during *rabi* season from 2017-18 to 2019-20 (3 consecutive year). As per the agro climatic Zones of Rajasthan, Sri Ganganagar district falls under Irrigated North Western Plain Zone-1b. Total 250 FLDs on chickpea were carried out by KVK, Sri Ganganagar of Rajasthan to harness of production potentialities of demonstrated chickpea variety GNG-1958 along with full cultivation package of practices in 100 ha area. The technologies to be demonstrated for chickpea were identified based on Participatory Rural Approach (PRA) technique. Under demonstration, 0.4 ha area is allotted for individual partner farmer and adjacent 0.4 ha was considered local check (farmers' practice). Farmers' were trained to follow the improved package and practices of chickpea cultivation recommended for Irrigated North Western Plain Zone-1b. The required critical inputs like improved variety seed (GNG-1958), for seed treatment biofertilizer like Rhizobium, PSB culture and Trichoderma spp., and IPM kits were supplied to the farmers' from the scheme budget and remaining inputs by farmers themselves. Farmers' were advised to use proper seed rate (72 kg ha^{-1}) with recommended package of practices. The sowing method keeping 30×10 cm spacing was demonstrated on their field. For fertilizer management, application of 20 Kg N+40 Kg P_2O per ha in the form of Urea and DAP as per demonstration were given. The seed was treated before sowing with *Rhizobium/*PSB @ 600g/ha seed and Trichoderma viridae @ 10g/kg seed, weed management (Pendimethalin 30 EC @ 2.5 l ha^{-1}) and pest management one spray of Imamectin benzoate 5 SG @ 0.5g/l and another spray of neem based insecticide (1000 ppm) @ 3ml/l and Melathion (50 EC) @ 800 ml/ha as per need at pod borer infestation. Regular visits to the demonstration field by KVK scientists ensured proper guidance to the partner farmers. During course of demonstrations for capacity building all the participating farmers' were trained on various aspects of chickpea production technologies. At flowering or maturity stage of crop, field days and group meetings were also organized to provide the opportunities for other farmers to witness the benefits of demonstrated technologies. Simultaneously, a feedback from the farmers also taken on the demonstrated technology. Farmers' followed the full package of practices of chickpea cultivation. In case of local check, traditional practices were followed by using existing varieties. Data were collected from both the demonstration as well as local check plot of partner farmers through personal contacts with the help of well-structured interview schedule and the finally extension gap, technology gap and technology index were worked out suggested by Raj *et al*., (2013) [7] as per formula given below:

% increase in yield = (Yield of improved technology–Yield of farmer practice /Yield of farmer practice ×100

Technology gap = Potential yield (Kg/ha) - Yield of improved technology (Kg/ha.)

Extension gap = Yield of improved technology (Kg/ha) - Yield under farmer practice (Kg/ha.)

$$\text{Technology index} = \frac{\text{Potential yield- Yield of improved technology}}{\text{Potential yield}} \text{ X } 100$$

Additional cost (₹/ha.) = Improved technology cost (₹/ha.) - Farmer practice cost (₹/ha.)

Additional return (₹/ha.) = Improved technology (₹/ha.) - Farmer practice return (₹/ha.)

Effective gain (₹/ha) = Additional return (₹/ha.) - Additional cost (₹/ha.)

Results and Discussion
Before implementing frontline demonstrations at the farmer's field, participatory rural appraisal was done. Based on this, major gap were observed between improved technology and farmer' s practice of chickpea cultivation in Sriganganagar district of Rajasthan (Table 1). Among varying technological component partial gap was observed in the component *viz*., variety, seed rate, seed treatment, method of sowing, weed management, fertilizer management and plant protection measures. These gaps observed at the farmers field are ascribed to the slow pace of extension activities, coupled with unreached extension system, poor accessibility of advanced or improved agro-technologies especially among small holder farmer's and other vulnerable groups (Shivran *et.al*, 2020) [10]. Under farmer's practice, generally seed of local/old variety with low yield potential was sow instead of newly recommended varieties for the zone with improper application of improved recommended package technologies. On the basis of observed gap, under the demonstration improved variety seed of GNG-1958, fungicide, insecticide and *Rhizobium* bio-fertilizer for seed treatment, herbicide for weed management and insecticide for plant protection measure were provided to the partner farmers by the Krishi Vigyan Kendra and other component *viz.* chemical fertilizers and all other crop management practices were timely performed by the partner farmer itself under the supervision of KVK scientist. Similar findings have also been observed by Saikia *et al.* (2018) [9] and Bhargav *et al.* (2017) [3].

Yield attributing traits
Under improved technology the number of productive pods per plant was 40.4, 34.6 and 37.7 as compared to farmer's practice 32.3, 28.4, 30.3 during the year 2017-18, 2018-19 and 2019-20, respectively. There was an increase of 25.08, 21.83 and 24.42% in number of productive pods under demonstration of improved technology. Under improved technology the average number of productive pods per plant was 37.57 and 30.33 under farmers practice, thus there were 23.78% more pods per plant under improved technology demonstrations. These results confirm the findings of Meena and Singh (2017) [5, 6].

Chickpea yield
Under National Food Security Mission-Pulses, total 250 cluster frontline demonstrations of chickpea were demonstrated during 2017-18 to 2019-20 to showcase potentials of demonstrated improved variety and performance of recommended package of practices in agro-climatic zone of Sri Ganganagar. The findings obtained during last three years demonstrations are presented in Table 3 revealed that the average seed yield of chickpea through improved technology ranged from 17.85 to 19.57 q/ha as compared to 15.57 to 16.19 under farmers practice (Local check). Average yield of total 250 demonstrations was 18.52 q/ha from improved technology whereas, the average yield from farmer's practices

was 15.95 q/ha. Under improved technology recorded 10.87 to 20.88 per cent increase in yield over the local check. Thus, there was on an average 15.33 per cent increase in demonstration yield over local check during three years of demonstrations. Demonstrated chickpea variety GNG-1958 gave the highest seed yield (19.57 q/ha) during year of 2017-18. The results also revealed that seed yield under improved technology as well as under farmer's practices were higher than the district and state average yield during all the years of demonstrations. On an average the results clearly indicate that the increase in yield in demonstration over local check was the impact of improved production technology of chickpea over the existing practices toward enhancing the yield of chickpea in different clusters of Sri Ganganagar district. Fluctuations in yield observed during the study years were mainly on account of variation in soil condition, its fertility levels, rainfall pattern, sowing time and crop management practices. The higher yield of chickpea could be attributed due to adoption of improved variety with improved production practices of chickpea. These results corroborate the findings of Reager *et al.* (2020) [8] and Meena *et al.* (2020) [5, 6] in green gram, Wadkar *et al.* (2018) [11] in chickpea. Further, the results also revealed that seed yield under demonstrations as well as under farmers practices were higher than the district and state average yield during all the year of investigations. However, on an average, 6.80 q/ha higher seed yield of chickpea was recorded under improved technology over district average. Similarly, 7.50 q/ha higher seed yield of chickpea was recorded under improved technology over district average. Moreover, higher seed yield was also recorded under farmers practice over district and state average. It was due to use of high yielding improved variety, improved agronomic practices and adoption of improved management practices. Shivran *et al.*, 2020 [10] also reported that on an average 1032, 727 kg/ha higher grain yield of Indian mustard was recorded under front line demonstrations over district and state average, respectively.

Adoption gap

Data (Table 4) revealed that adoption gap is considered a key factor for enhancing the productivity of chickpea. Gap analysis was done by evaluating the extension gap, technology gap and technology index to measure the magnitude of adoption technology.

Technology gap

The data of table 4 depicted the technology gap in demonstration yield against potential yield which ranged from 4.43 to 6.15 q/ha during different years of demonstration. Technology gap was maximum (6.15 q/ha) with demonstration variety GNG-1958 during 2018-19 and minimum (4.43 q/ha) during 2019-20. On an average technology gap during three years of demonstrations were 5.48 q/ha for chickpea cultivation in Sri Ganganagar district. The technology gap observed may be attributed to dissimilarity in crop management practices and variation in soil fertility and local agro-climatic situations. It indicates the constraints in implementation of technology and drawbacks in our package of practices. This also reflects the poor extension activities, which resulted in lesser adoption of package of practice by farmer. Hence, extension activities and a location specific technological recommendation appear to be necessary to decline the technology gap.

Extension gap

Extension gap is considered a parameter to know the yield difference between the demonstrated improved technology and farmer's practices. Results of the demonstrations (Table 4) stated that the extension gap ranging between 1.75-3.38 q/ha was found between improved technology and farmer's practices during period of study. The extension gap was highest 3.38 q/ha and lowest 1.75 q/ha during the year 2017-18 and 2018-19, respectively. On an average extension gap during period of study were 2.57 q/ha for chickpea cultivation in Sri Ganganagar district. So as to enhance the farmers income, there is need to reduce the wider extension gap, therefore, it is necessity to educate the farmer's through various means for more adoption of recommended improved high yielding varieties and implementation of latest agro-technique (Reager *et al.*, 2020) [8] and (Meena *et al*., 2020) [5, 6] in green gram.

Technology index

The technology index is a parameter to show the feasibility of the improved technology at the farmer's fields. The lower value of technology index indicate more is the feasibility of improved technology and higher technology index reflected the inadequate transfer of proven technology to growers and poor extension services. Data on technology index presented in table 4 shows that technology index varied from 18.46 to 25.63 per cent. During study period of frontline demonstrations the highest technology index 25.63 per cent and lowest 18.46 per cent was recorded during year of 2018-19 and 2017-18, respectively. Further, on an average technology index 22.82 per cent was observed during three experimental years of chickpea in Sri Ganganagar district, which shows the efficacy of good performance of technical interventions. This will accelerate the adoption of demonstrated technical intervention to increase the yield performance of chickpea at farmer's field. The technology index infers that there is ample scope in improvement in production and productivity of chickpea in the district. Similar findings were recorded by Reager *et al.* (2020) [8], Wadkar *et al.* (2018) [11] and Bhargav *et al.* (2017) [3].

Economics

Economics, an important parameter to reject and accept the technology was estimated under the investigations. Seed yield, cost of variable inputs, labour charge and sale price of produce determine the economics return and these vary from year to year. Economics of improved technology under frontline demonstration were estimated on the basis of prevailing market rates recorded higher gross monetary return (₹87120/ha.), additional returns (₹12408/ha.), net returns (₹58019/ha.) and effective gain (₹10457/ha.) with improved technology demonstration compare to farmer's practice in the year 2019-20. The higher sale price of produce in spite of low production and lower additional cost of input during 2019-20 gave highest additional return (₹12408/ha) under improved technology demonstration over farmers practice. Under the present investigation, improved technology fetched higher net return to the tune of ₹40460/ha to ₹58019/ha with the mean of three years was (₹47565 /ha.). However, under farmer practices the net return ranged to the tune of ₹30841/ha to the ₹47562/ha. over the years and its average value fetched to ₹39277/ha. Further, on the average of all three years of study revealed that improved technology demonstration gave higher average gross return (₹76260 /ha.), additional returns (₹10404/ha.), average net return (₹47565 /ha.), effective gain (₹8289/ha.) and benefit: cost ratio (2.65) compare to farmer practice. The higher effective gain and additional returns obtained under frontline demonstrations could be due to improved technological intervention and non-monetary factors, timely operations of crop management practices and scientific monitoring at different stages of crop. Further, favourable benefit cost ratio obtained under improved technological intervention under specific agro-ecological situation proved the economic viability of the technological intervention and convinced the farmers on utility of interventions. Similar economic benefits owing to adoption of improved technology interventions were also reported by Reager *et al.* (2020) [8] and Meena *et al*. (2020) [5, 6].

Table 1: Details of technology intervention and farmer's practices under FLDs on chickpea in Sri Ganganagar district of Rajasthan

Technology component	Improved technology	Farmer practice	Gap%
Farming Situation	Irrigated	Irrigated	Nil
Variety	GNG-1958 (Marudhar)	Old variety/own procured seed-60% Improved variety-40%	Partial
Seed rate	72 kg/ha. for GNG-1958	48-50 kg/ha – 65% 60-72 kg/ha – 35%	Partial
Seed treatment	Seed treatment with Carbendazim @ 1.5 g/kg seed, *Trichoderma harzianum* @ 10 g/kg seed and Imidacloprid (17.8 SL) @2 ml/kg seed.	No seed treatment – 80% Seed Treatment – 20%	Partial
Bio-fertilizer	Rhizobium & PSB culture @ 600 gm each/ha seed	Rarely bio-fertilizer inoculation	Partial
Weed management	One hoeing at 30-35 DAS or Pendimethalin (30% EC) @ 2.5 l/hectare in 600 litre of water as pre-emergence.	One hand weeding or hoeing at 30-35 DAS = 60% No weeding or hoeing = 10% Pendimethalin (30% EC) @ 2.5 l/ha. = 30%	Partial
Fertilizer Management	As per recommendation of 20 kg Nitrogen and 40 kg phosphorus per ha or soil test basis.	60 kg DAP (11 kg N and 28 kg P /ha.) – 63% or 87 kg DAP (16 Kg N and 40 kg P /ha) – 37% or 32 Kg phosphorus through SSP	Partial
Irrigation	First irrigation at 50-55 days after sowing (Branching initiation) and second irrigation 100 days after sowing. If needed only one irrigation than at 60-65 days after sowing.	As per need based.	Partial
Plant protection measure For pod borer	Use of Indoxacarb 14.5 sc @ 1ml/lit. or Imamectin Benzoate 5% sg @ 0.5 g/lit., Neem extract 3ml/lit and Melathion (50 EC) 800 ml/ha or Need based timely spraying of recommended pesticide.	Non judicious use of pesticides and fungicides	Partial
Root rot	Carboxin 37.5%+Thiram 37.5% (75%WS) as seed treatment or 2.5 kg *Trichoderma harzanium* along with 50 kg FYM.		

Table 2: Yield attributing traits of chickpea under demonstration *vis a vis* farmers practice

Year	Number of pods/plant			Seed index		
	IT	FP	% increase	IT	FP	% increase
Rabi 2017-18	40.4	32.3	25.08	24.2	16.5	46.67
Rabi 2018-19	34.6	28.4	21.83	22.5	15.6	44.23
Rabi 2019-20	37.7	30.3	24.42	23.8	16.3	46.01
Mean	37.57	30.33	23.78	23.50	16.13	45.66

IT: Improved technology; FP: Farmer's practice (Local check)

Table 3: Yield performance and yield analysis of demonstrated chickpea variety in Sriganganagar district of Rajasthan

Year	No. of Demo.	Area (ha.)	IT average yield (q/ha)	FP average yield (q/ha)	% increase in yield over FP	District average yield (q/ha)	State average yield (q/ha)	IT Yield (q/ha) over FP	Yield (q/ha) over district average		Yield (q/ha) over state average	
									IT	FP	IT	FP
2017-18	75	30	19.57	16.19	20.88	10.04	10.74	3.38	9.53	6.15	8.83	5.45
2018-19	125	50	17.85	16.10	10.87	12.08	11.52	1.75	5.77	4.02	6.33	4.58
2019-20	50	20	18.15	15.57	14.24	13.06	10.80	2.58	5.09	2.51	7.35	4.77
Total/Mean	250	100	18.52	15.95	15.33	11.73	11.02	2.57	6.80	4.23	7.50	4.93

IT: Improved technology; FP: Farmer's practice (Local check)

Table 4: Gap analysis in chickpea under front line demonstration and farmer practice

Season and year	Technology yield gap (q/ha)	Extension yield gap (q/ha)	Technology index (%)
Rabi 2017-18	4.43	3.38	18.46
Rabi 2018-19	6.15	1.75	25.63
Rabi 2019-20	5.85	2.58	24.38
Mean	5.48	2.57	22.82

Table 5: Economic analysis of FLDs on chickpea in Sriganganagar district of Rajasthan

Season and year	Average cost of cultivation (₹/ha)		Additional cost in IT ((₹/ha.)	Sale price ((₹q^{-1})	Average gross return ((₹/ha)		Additional return in IT ((₹/ha.)	Average net return ((₹/ha)		Effective gain ((₹/ha)	Benefit-Cost Ratio	
	IT	FP			IT	FP		IT	FP		IT	FP
Rabi 2017-18	28034	26025	2009	3500	68495	56866	11629	40460	30841	9619	2.44	2.19
Rabi 2018-19	28948	26563	2385	4100	73165	65990	7175	44217	39427	4790	2.53	2.48
Rabi 2019-20	29100	27150	1950	4800	87120	74712	12408	58019	47562	10457	2.99	2.75
Mean	28694	26579	2115	4133	76260	65856	10404	47565	39277	8289	2.65	2.47

IT: Improved technology; FP: Farmer's practice (Local check)

Conclusion

Finding of present study concluded that adoption of improved technologies through frontline demonstrations has a long-term impact on production and productivity of chickpea and changing the knowledge, attitude and skills of farmers. The per cent increment in yield of chickpea to the extent of 10.87 to 20.88 under improved technology as compared to the farmer's practice created greater awareness. Under demonstrations farmers obtained net profit of ₹47565/- ha with B: C ratio of 2.65. Participatory farmers have opined that they will continue apply of accepted technological package in coming season. The beneficiary farmers of demonstrations also play an important role as source of information and quality seed for wider dissemination of the high yielding variety of chickpea for other nearby farmers.

References

1. Anonymous. Rajasthan Agricultural Statistics at a Glance, Statistical cell, Commissionerate of Agriculture, Govt. of Rajasthan, Jaipur 2018.
2. Anonymous. Agricultural Statistic at a glance, Department of Agriculture and coperation, Directorate of Economics and Statistics, Ministry of Agriculture and Farmer welfare, Government of India. Fourth advance estimate 2019.
3. Bhargav KS, Khedkar NS, Verma G, Ambawatia GR, Gupta N, Patel N. Evaluation of front line demonstration on chickpea in Shajpur District of MP. Int. J Pure Appl Biosci 2017;54(4):293-297.
4. Kumar R. Assessment of technology gap and productivity gain through crop technology demonstration in chickpea. Indian J Agric. Res 2014;48(2):62-164.
5. Meena ML, Singh Dheeraj. Technological and extension yield gaps in green gram in Pali district of Rajasthan, India. Legume Res 2017;40(1):187-190.
6. Meena Rupesh Kumar, Singh Bhupender, Shinde Kuladip Prakash, Meena, Ravi Kumar. Cluster Front Line Demonstrations of Green Gram under National F₹d Security Mission in Sriganganagar District: An Evaluation of Production & productivity of green gram. Int. J Curr. Microbiol. Appl. Sci 2020;9(6):984-990.
7. Raj AD, Yadav V, Rathod JH. Impact of Front Line Demonstrations (FLD) on the Yield of Pulses. Int. J Sci. Res 2013;3(9):1-4.
8. Reager ML, Kumar Upender, Mitharwal BS, Chaturvedi, BS. Productivity and sustainability of green gram as Influenced by improved technology of CFLD under hyper arid partially irrigated zone of Rajasthan. Int. J Curr. Microbiol. Appl. Sci 2020;9(5):1978-1986.
9. Saikia Nabadeep, Nath Kapil Deb, Chowdhury Pulakabha. Impact of front line demonstration on popularization of black gram *var*. PU 31 in Cachar district Barak Valley region of Assam. J Pharmacogn. Pytochem 2018;7(4):940-942.
10. Shivran RK, Singh Ummed, Kishore Naval, Kherawat Bhagwat Singh, Pant Richa Mehra Keshav. Gap analysis and economic viability of front line demonstration in Indian Mustard (*Brassica juncea* L.) under hyper arid partial irrigated zone of Rajasthan. Int. J Bio-resource Stress Manag 2020;11(4):353-360.
11. Wadkar JR, Tijare BR, Giri MD, Jaybhaye CP, Chavhan RT, Bawkar SO *et al*. Impact of front line demonstration on the yield and economics of chickpea in Buldhana district of Maharashtra, India. Int. J Curr. Microbiol. Appl. Sci 2018;6:311-314.