

SPATIAL PATTERNS OF FARMER PARTICIPATION, CONSTRAINTS AND PRIORITY INTERVENTIONS UNDER VIKASIT KRISHI SANKALP ABHIYAN (VKSA): EVIDENCE FROM AGRO-ECOLOGICAL SITUATIONS OF VARANASI DISTRICT, UTTAR PRADESH

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ABSTRACT

Indian agriculture faces persistent challenges, including small and fragmented landholdings, labour shortages, climate variability, and increasing production risks. In this context, large-scale, campaign-based extension programmes serve as strategic tools for rapid technology dissemination and farmer mobilization. The Vikasit Krishi Sankalp Abhiyan (VKSA), implemented during Kharif 2025 in Varanasi district, Uttar Pradesh, aimed to promote scientific crop and livestock practices, enhance awareness of government schemes, and strengthen convergence among Krishi Vigyan Kendras (KVKs), line departments, and local institutions. The present study analyzed AES- and block-wise farmer participation, identified major constraints, and documented suggestive measures for improving technology adoption across three Agro-Ecological Situations (AESs). A total of 600 farmers (200 per AES) were surveyed through group interactions, demonstrations, and participatory sessions. Participation intensity and percentage share revealed that AES-3 (Western and Southern parts) accounted for the highest engagement (49.8%), followed by AES-2 (25.4%) and AES-1 (24.8%), with Baragaon recording the highest intensity per Gram Panchayat. Crop losses due to blue bulls and stray animals, livestock reproductive disorders, and low awareness of integrated disease and nutrient management emerged as the top constraints, showing strong rank concordance across AESs. Farmers prioritized pre-season VKSA campaigns, MGNREGA-based labour support, and PMFBY coverage for stray animal losses as key measures, though AES-specific preferences varied. The study highlights the importance of integrating participation intensity metrics and rank-based diagnostics into extension planning. Evidence-based, participatory, and location-specific interventions, including institutionalizing pre-season VKSA campaigns, converging labour support with agricultural operations, and strengthening insurance coverage, can enhance farmer resilience and the effectiveness of large-scale extension programmes.

KEYWORDS: VKSA, farmer participation, agro-ecological situations, constraints, suggestive measures, evidence-based extension.

INTRODUCTION

Indian agriculture continues to face challenges related to small and fragmented landholdings, climate variability, labour shortages, and increasing production risks. In this context, agricultural extension systems play a critical role in facilitating the adoption of improved technologies, enhancing farmers' knowledge and skills, and strengthening farm-level risk management capacities. Effective extension interventions are particularly important for translating research outputs into field-level impacts through participatory, demand-driven, and location-specific approaches (Anderson & Feder, 2007; Swanson & Rajalahti, 2010).

The Viksit Krishi Sankalp Abhiyan (VKSA) is a large-scale national extension campaign launched by the Ministry of Agriculture & Farmers' Welfare and coordinated by the Indian Council of Agricultural Research (ICAR) to directly connect scientists with farmers ahead of the Kharif season (May 29–June 12, 2025). It was implemented across over 700 districts and more than 65,000 villages' nationwide, engaging 2,170 expert teams drawn from ICAR institutes, 731 Krishi Vigyan Kendras (KVKs), agricultural universities, state departments, and Farmer Producer Organisations (FPOs). Through this structured outreach, VKSA aimed to promote scientific farming methods, balanced soil and nutrient management, climate-resilient practices, and awareness of government schemes, while capturing farmers' feedback to inform future research and policy (Singh et al., 2025).

The campaign achieved extensive grassroots coverage, organizing 60,917 programmes and directly engaging more than 1.35 crore farmers from over 1.40 lakh villages across 34 States and Union Territories. Emphasizing two-way interaction, VKSA facilitated farmer-scientist dialogues on local constraints and tailored advisories, thus embodying a participatory extension model that strengthens technology uptake and aligns extension with farmers' decision-making needs (Singh et al., 2025).

During Kharif 2025, the Vikasit Krishi Sankalp Abhiyan (VKSA) engaged 30,156 farmers across 135 Gram Panchayats in Varanasi, spanning multiple Agro-Ecological Sub-regions (AESs) and administrative blocks. The campaign generated AES- and block-wise participation data, along with ranked matrices of farmer-perceived constraints and suggested interventions in crop production, livestock management, labour availability, and risk mitigation. Analysis of these datasets is critical for understanding spatial variations in outreach and for informing targeted extension strategies.

Previous studies emphasize that evidence-based planning and participatory diagnostics enhance the effectiveness of extension programmes and improve technology adoption outcomes (Rogers, 2003; Davis et al., 2012). However, empirical studies integrating participation intensity, concentration indices, and rank concordance analysis under large-scale extension campaigns remain limited at the district and AES levels. Therefore, the present study was undertaken to comprehensively analyze VKSA Kharif 2025 data from Varanasi district, with a view to informing targeted extension strategies and policy decisions.

OBJECTIVES OF THE STUDY

The present study was undertaken with the following specific objectives:

1. To analyze AES-wise and block-wise farmer participation and participation intensity under the Vikasit Krishi Sankalp Abhiyan (VKSA) during Kharif 2025 in Varanasi district.
2. To identify and prioritize major constraints faced by farmers and corresponding suggestive measures for improving technology adoption across different Agro-Ecological Situations.
3. To derive evidence-based extension and policy implications for strengthening the effectiveness of large-scale agricultural extension campaigns like VKSA.

MATERIALS AND METHODS

Implementation Framework and Route Mapping of VKSA

The Viksit Krishi Sankalp Abhiyan (VKSA) in Varanasi district was implemented through a systematic route-map-based field mobilization strategy coordinated by Krishi Vigyan Kendra (KVK), Varanasi under Acharya Narendra Deva University of Agriculture and Technology (ANDUAT), Ayodhya. Pre-planned route maps ensured uniform coverage of villages, Gram Panchayats, and blocks, facilitating effective farmer interaction throughout the campaign.

Figure-1 depicts the route-based operational framework of VKSA implemented during 29 May to 12 June 2025. Three teams of Subject Matter Specialists, including scientists from ICAR–Indian Institute of Vegetable Research (ICAR-IIVR), conducted village-level visits through three daily sessions to ensure comprehensive coverage across blocks and Agro-Ecological Situations (AESs). The figure also presents the spatial distribution of AESs in Varanasi district and corresponding block-wise farmer participation during Kharif 2025, categorized into AES-1 (Upper Ganga–Varuna flood-prone plains), AES-2 (Varuna–Gomati medium and irrigated zone), and AES-3 (western and southern upland areas).

outreach of the campaign across the district. Large-scale extension programmes with intensive field-level engagement have been widely reported to enhance technology exposure and farmer participation when implemented through decentralized and location-specific approaches (Swanson & Rajalahti, 2010; Glendenning et al., 2010).

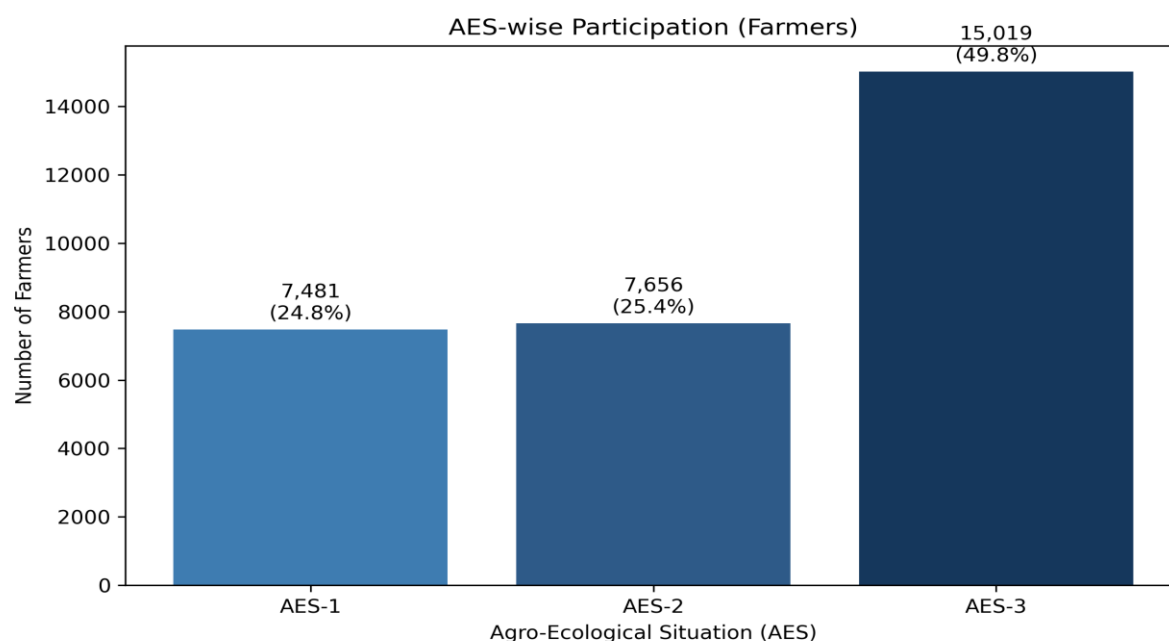


Figure: 2. AES-wise participation of farmers with percentage share during VKSA in Varanasi District

Figure: 2. Indicated that the Agro-Ecological Situations, AES-3 (Western and Southern part) accounted for the highest share of participation (49.8%), followed by AES-2 (25.4%) and AES-1 (24.8%). This pattern suggests relatively greater responsiveness of farmers in AES-3, which may be attributed to higher production intensity, diversified farming systems, and stronger extension–farmer interfaces in the region. Similar variations in participation across agro-ecological zones have been documented in earlier extension impact studies (Anderson & Feder, 2007; Singh et al., 2018). At the block level, Kashi Vidyapeeth, Harahua, and Sevapuri emerged as major contributors to overall participation, highlighting their strategic importance for extension investment.

Participation intensity, measured as the number of farmers per Gram Panchayat, varied considerably across blocks. Baragaon recorded the highest intensity (353.33 farmers per GP), followed by Pindra and Kashi Vidyapeeth, whereas Cholapur and Chiraigaon exhibited relatively lower intensity. These findings indicate that participation intensity does not necessarily correspond with absolute turnout, reflecting differences in mobilization efficiency, local leadership, and extension logistics. Earlier studies have similarly emphasized that participation density is a more sensitive indicator of extension effectiveness than total attendance alone (Feder et al., 2011; Davis et al., 2012).

Table: 1. AES-wise and block-wise farmer participation, percentage share and participation intensity under VKSA in Varanasi district during Kharif 2025

Agro-Ecological Situation (AES)	Block	Total number of farmers	Number of Gram Panchayats	Percentage share (%)	Participation intensity (farmers/GP)
AES-1 (Upper Ganga–Varuna Plain)	Baragaon	2,120	6	7.03	353.33
	Harahua	5,361	23	17.78	233.09
AES-1 Total	—	7,481	29	24.80	258.66
AES-2 (Varuna–Gomati Interference)	Pindra	4,473	16	14.83	279.56
	Cholapur	1,557	9	5.16	173.00
	Chiraigaon	1,626	9	5.39	180.67
AES-2 Total	—	7,656	34	25.40	225.18
AES-3 (Western and Southern part)	Sevapuri	5,051	27	16.75	187.07
	Araziline	3,442	18	11.41	191.22
	Kashi Vidyapeeth	6,521	27	21.63	241.52
AES-3 Total	—	15,014	72	49.80	208.53
Grand Total	—	30,156	135	100.00	223.38

Statistical summary (Blocks, n = 8)	Mean	3,769.50	16.88	12.50	234.74
	SD	1,847.12	7.82	6.13	59.95
	CV (%)	49.00	46.34	49.04	25.54

GP=Gram Panchayat

The statistical summary reveals high variability in total farmer participation across blocks (CV = 49.00%), while participation intensity showed moderate variability (CV = 25.54%), suggesting relatively stable engagement per Gram Panchayat despite heterogeneity in block size and population. The mean participation intensity of 234.74 farmers per Gram Panchayat underscores the extensive outreach achieved under VKSA. These results support the growing consensus that extension planning and evaluation should incorporate both scale-based indicators (total participation) and efficiency-based indicators (participation intensity) to ensure equitable and effective delivery of services (Swanson, 2006; Birner et al., 2009,).

Constraints Faced by Farmers in different AES

The AES-wise and district-level constraints faced by farmers during VKSA Kharif 2025 are presented in Table 2. The results indicate strong consistency in farmer perceptions across AESs, although the intensity of constraints varied slightly by agro-ecological context.

At the district level, crop losses due to blue bulls and stray animals emerged as the most severe constraint, with the highest overall mean score (3.79) and Rank I. This constraint ranked first in AES-1 and AES-3 and second in AES-2, highlighting its widespread and cross-cutting nature. Similar observations have been reported from the eastern Gangetic plains, where unmanaged stray cattle significantly reduce crop yields, increase production risks, and discourage farmers from adopting improved technologies (Birthal et al., 2014; Government of India, 2022). The prominence of this constraint underscores the urgent need for coordinated policy interventions combining community-based animal management, fencing support, and insurance coverage.

The second most critical constraint was the prevalence of reproductive disorders and infertility in livestock (overall mean score 3.72), which ranked first in AES-2 and second in AES-1 and AES-3. This finding aligns with earlier studies reporting declining livestock productivity due to poor reproductive health, inadequate veterinary services, and nutritional imbalances in mixed farming systems of eastern India (Kumar et al., 2018; FAO, 2019, Sahoo et al., 2022, Kale et al., 2021, and Srilatha et al., 2019). The high ranking of this constraint emphasizes the increasing role of livestock as a critical livelihood component and the necessity of integrating animal health services within extension programs such as VKSA.

Low awareness about Integrated Disease Management (IDM) and Integrated Nutrient Management (INM) in paddy, particularly related to false smut disease and micronutrient deficiencies, ranked third overall (mean score 3.59). Previous studies have similarly highlighted inadequate dissemination and adoption of IDM and INM practices as key factors limiting productivity in rice-based systems (Yadav et al., 2000; ICAR, 2021). Strengthening season-specific advisory services and on-field demonstrations could substantially improve adoption levels.

Lower-ranked constraints, including high input costs, labour shortages, water scarcity during Kharif, and limited access to quality millet seeds and processing units, though secondary in ranking, represent important structural bottlenecks. Labour scarcity, in particular, has been widely reported in eastern Uttar Pradesh due to rural out-migration and rising wage rates, affecting the timeliness of agricultural operations (Singh et al., 2019; NABARD, 2020). These constraints cumulatively influence farmers' risk perceptions and their willingness to invest in improved practices.

Spearman rank correlation (ρ) of constraint rankings across Agro-Ecological Situations (AES).

The heat map (Figure.3) shows pairwise Spearman correlation coefficients for the ranking of 11 constraints across AES-1 (Ganga–Varuna Plain), AES-2 (Varuna–Gomati Interference), and AES-3 (Western & Southern part). Diagonal cells ($\rho = 1.00$) indicate perfect self-correlation, while off-diagonal values reflect agreement between AES pairs: AES-1 vs AES-2 ($\rho = 0.92$), AES-1 vs AES-3 ($\rho = 0.87$), AES-2 vs AES-3 ($\rho = 0.77$). Darker shades represent stronger correlation. Overall, high ρ values (>0.75) indicate strong consensus on constraint priorities across AES, supporting district-wide core interventions with minor AES-specific adjustments.

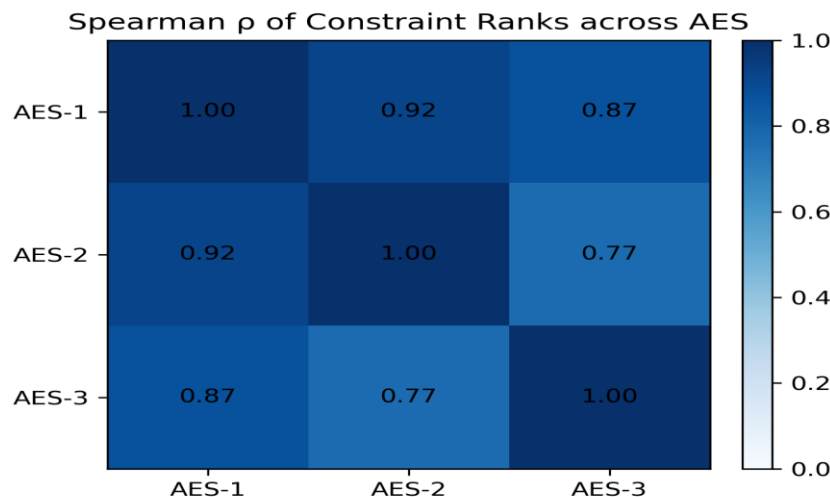


Figure 3. Spearman correlation matrix of constraint ranks across AES

AES-Wise Suggestive Measures to Overcome Constraints

Farmer-suggested measures recorded during VKSA are summarized in Table-3. Unlike constraints, greater variability was observed in the ranking of measures across AESs, indicating the need for location-specific intervention strategies.

At the district level, the most preferred measure was implementation of VKSA before the beginning of every cropping season (overall mean score 3.55; Rank I). This measure ranked first in AES-1 and AES-2, reflecting farmers' demand for timely advisory services before critical decision-making stages. This finding corroborates earlier studies emphasizing the effectiveness of pre-season advisory services in improving decision-making and technology adoption (Davis et al., 2010; ICAR, 2023).

The second most preferred measure was provision of labour support through MGNREGA (overall mean score 3.48), which ranked first in AES-3. This highlights labour scarcity as a dominant concern in the western and southern parts of the district. Similar evidence suggests that strategic use of MGNREGA can mitigate labour shortages during peak agricultural periods (Reddy & Reddy, 2013; Government of India, 2021). Coverage of crop losses due to blue bulls and stray animals under PMFBY ranked third overall (mean score 3.45), directly aligning with the top-ranked constraint (Mukherjee & Pal, 2017).

Promotion of pest- and disease-resistant vegetable varieties, removal of restrictions on Sagaun-based agroforestry, and intercropping with high-value crops received moderate preference, indicating farmers' interest in income diversification alongside risk mitigation. Lower-ranked measures such as digital awareness campaigns and vocational training suggest the need for better contextualization and delivery mechanisms for such interventions.

Spearman rank correlation (ρ) of measure rankings across Agro-Ecological Situations (AES)

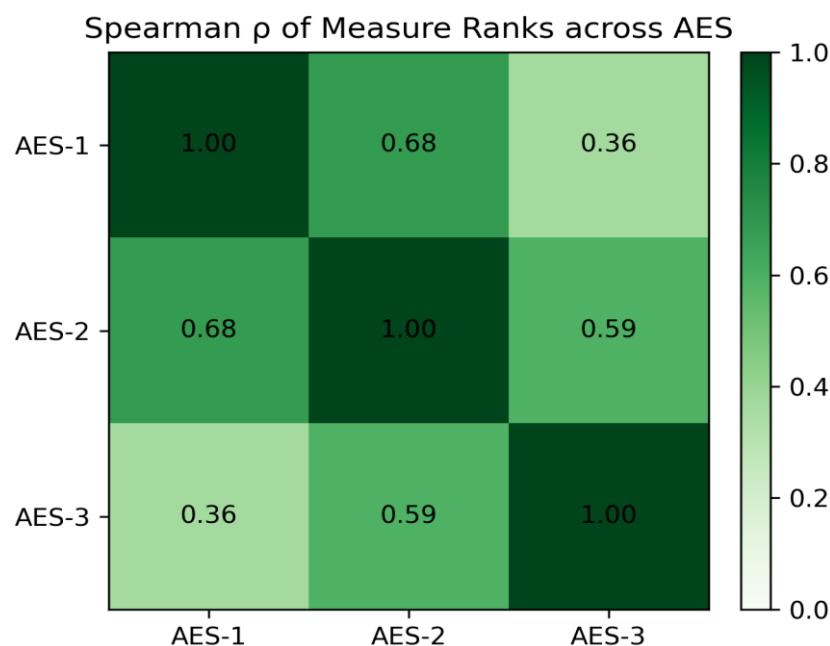


Figure-4. Spearman correlation matrix of measure ranks across AES

This heatmap (figure-4) presents Spearman correlation coefficients for the ranking of 11 suggestive measures across AES-1, AES-2, and AES-3. Diagonal cells ($\rho = 1.00$) show perfect self-correlation, while off-diagonal values reveal moderate to low agreement: AES-1 vs AES-2 ($\rho \approx 0.68$), AES-2 vs AES-3 ($\rho \approx 0.59$), AES-1 vs AES-3 ($\rho \approx 0.36$). Compared to Figure 4, these lower correlations indicate greater variability in preferred measures across AES, suggesting that while a common core of interventions is feasible, AES-specific customization is essential for measures such as MGNREGA labour support (favoured in AES-3) and seasonal VKSA campaigns (prioritized in AES-1 and AES-2).

CONCLUSION

The VKSA Kharif 2025 campaign in Varanasi district, implemented through a structured route-map approach, successfully mobilized farmers across diverse agro-ecological settings and generated robust, policy-relevant datasets. The consistency observed in constraint rankings across AESs—particularly regarding stray animal damage, livestock reproductive health, and crop health literacy—highlights the urgency of district-wide core interventions. At the same time, AES-wise variability in preferred measures underscores the importance of customized extension packages, especially with respect to labour support, agroforestry, and mechanization. Institutionalizing VKSA as a mandatory pre-season extension activity, strengthening PMFBY coverage for stray animal losses, and integrating MGNREGA labour support with agricultural operations can substantially enhance the effectiveness of future campaigns. Incorporation of participation intensity indicators and rank-based diagnostic tools into VKSA monitoring frameworks will further enable adaptive planning, ensuring that VKSA evolves from a time-bound campaign into a continuous, responsive, and evidence-driven agricultural extension system.

POLICY IMPLICATIONS

The convergence of farmer-identified constraints across agro-ecological situations calls for district-level core interventions focusing on stray animal management, livestock reproductive health, and improved dissemination of IDM and INM practices. At the same time, variability in preferred measures highlights the need for AES-specific flexibility under VKSA. Institutionalizing pre-season VKSA campaigns, converging MGNREGA with agriculture to address labour shortages, and strengthening PMFBY coverage for stray animal damage can enhance farmer resilience. A decentralized and participatory extension approach is essential to ensure effective and sustainable implementation.

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Table: 2. Constraints faced by farmers in different AES of Varanasi District during Viksit Krishi Sankalp Abhiyan, Kharif 2025

(N=600)

S. No.	Constraints Faced by Farmers	AES-1 (Ganga Varuna Plain)			AES-2 (Varuna-Gomati interference)			AES-3 (Western and Southern part)			V
		Total Score	Mean Score Value	Rank Order	Total Score	Mean Score Value	Rank Order	Total Score	Mean Score Value	Rank Order	
1	Prevalence of reproductive disorder and Infertility problems in livestock	761	3.80	II	765	3.82	I	710	3.55	II	2
2	Crop losses due to Blue Bulls and stray animals	790	3.95	I	747	3.73	II	738	3.69	I	2
3	Less awareness about different subsidies/Government schemes	680	3.40	VI	655	3.27	VI	569	2.84	IX	1

4	Major infestation of Insect-pest and diseases in vegetable crops (White fly in Okra, Shoot & Fruit Borer in Brinjal, Root Borer in Raddish, Wilt etc)	713	3.56	IV	656	3.28	V	697	3.48	IV	2
5	Uncertain market prices and weak market linkage	686	3.43	V	702	3.51	IV	675	3.37	V	2
6	High cost of improved inputs and limited access to credit	526	2.63	IX	598	2.99	IX	634	3.17	VII	1
7	Water scarcity and low water table during Kharif season	466	2.33	X	643	3.21	VIII	580	2.90	VIII	1
8	Unavailability of good qualities millets seed and processing units	425	2.12	XI	492	2.46	XI	548	2.74	X	1
9	Weeds problem in DSR technique of Paddy crop	642	3.21	VII	578	2.89	X	659	3.29	VI	1
10	Problem of Labour and High wages in peak season	560	2.80	VIII	645	3.22	VII	489	2.44	XI	1
11	Low awareness about IDM (False smut) and INM in Paddy (Deficiency of Zn and Iron in nursery)	730	3.65	III	723	3.61	III	705	3.52	III	2

N = Total Number of Farmer/Participant

3. AES wise Suggestive measures to overcome the constraints recorded during Vikasit Krishi Sankalp Abhiyan, Kharif 2025 in Varanasi

(N=600)

S. No.	Suggestive Measures	AES-1 (Ganga Varuna Plain)			AES-2 (Varuna-Gomati interference)			AES-3 (Western and Southern part)		
		Total Score	Mean Score Value	Rank Order	Total Score	Mean Score Value	Rank Order	Total Score	Mean Score Value	Rank Order
1	High yielding new disease/pest resistance varieties of ICAR-IIVR for vegetables to be made available at the Panchayat Level	707	3.53	III	684	3.42	III	698	3.49	III
2	IPM, INM & IDM practices should be promoted by means of educating the farmers	682	3.41	VII	643	3.21	VIII	627	3.13	VIII
3	There is a need for systematic awareness campaigns by using digital tools to inform farmers about various Government schemes/ subsidies programs	655	3.27	X	587	2.93	XI	598	2.99	IX
4	Intercropping and crop diversification with high value crops such as banana, maize, flowers, Dragon fruit, tomato, chili are quite profitable hence needs to be promoted	683	3.40	VI	637	3.18	IX	691	3.45	VI
5	The government should implement Vikasit Krishi Sankalp Abhiyan (VKSA) before the beginning of every cropping season	735	3.67	I	703	3.51	I	695	3.47	IV
6	Promotion of vocational training and entrepreneurship opportunities in modern farming, especially for youth and women farmers	587	2.93	V	657	3.28	VI	561	2.80	XI

7	The government should remove the restriction of cutting of Sagaun trees, because farmers want to grow sagaun as commercial trees for their income	664	3.32	IX	678	3.39	IV	702	3.51	II
8	Availability of Good qualities millets Seeds should be promoted	632	3.16	XI	655	3.27	VII	595	2.97	X
9	Losses caused by blue bulls and stray animals should be covered under PMFBY	710	3.55	II	676	3.38	V	688	3.44	VII
10	The government should provide labour support to farmers through MGNREGA	689	3.44	IV	701	3.50	II	703	3.51	I
11	Smaller Agricultural/Horticultural machinery should be promoted by the Government	679	3.39	VIII	634	3.17	X	693	3.46	V

N = Total Number of Farmer/Participant