



RESEARCH ARTICLE

Equipping farmers adopting climate change through agromet advisory services of district agro-meteorological units in Western India

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Received: 09 July 2023

Revised accepted: 15 November 2023

ABSTRACT

An overview of the Agromet Advisory Services (AAS) offered by the District Agro-Meteorological Unit (DAMU) Project in Western India is provided in the present study. It highlights the significance of these services in enhancing agricultural productivity, mitigating weather-related risks and empowering farmers with timely, actionable information. These services aim to equip farmers with weather-based insights to optimize their farming decisions, aligning them with changing weather patterns and climatic conditions. The study outlines the key components of the AAS, including weather forecasting, generation of localized agro-advisories, capacity-building initiatives and collaborative partnerships. It emphasizes the utilization of meteorological data to create tailored weather forecasts encompassing crucial parameters such as rainfall, temperature, humidity, and wind patterns. Moreover, it highlights the dissemination of these forecasts through various accessible channels like SMS, mobile applications, radio broadcasts, and community engagements. The agro-advisories provide farmers with recommendations on crop selection, optimal planting and harvesting times, irrigation schedules, pest and disease management strategies, and post-harvest practices. In conclusion, the study highlights the pivotal role played by the DAMU Project's AAS in Western India's agriculture. It emphasizes their contribution towards sustainable farming practices, improved livelihoods for farmers and resilience-building in the face of climate change and weather uncertainties.

Key words: Agromet Advisory Services, Climate change, DAMU, Weather, Western India

INTRODUCTION

In the heartlands of Western India, a groundbreaking initiative is changing the way farmers interact with the weather. The District Agro-Meteorological Unit (DAMU) Project has introduced a game-changing service that offers tailor-made advice to farmers, helping them navigate the uncertainties of nature and improve their agricultural practices. Under Gramin Krishi Mausam Sewa (GKMS) scheme of India Meteorological Department (IMD), District AgroMet Units (DAMUs) were established at Krishi Vigyan Kendras (KVKs) in collaboration with Indian Council of Agricultural Research (ICAR) to implement block level AgroMet Advisory Services (AAS) for the farmers.

Imagine a farmer, residing in a remote village, receiving timely advice about when to sow seeds or irrigate crops based on local weather forecasts. This scenario is now a reality, thanks to the innovative Agromet Advisory Services launched by the DAMU Project. The key to this service lies in its integration of meteorological data with traditional agricultural practices. By utilizing sophisticated weather forecasting techniques, the DAMU Project provides farmers with crucial information regarding temperature variations, rainfall patterns, humidity levels, and more. This data is then translated into practical advice delivered directly to the farmers' fingertips through SMS, mobile apps, radio broadcasts, and local meetings. But it is not

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just about receiving weather updates; it is about empowering farmers with knowledge to make informed decisions. The agro-advisories sent out by the DAMU Project are customized to suit different crops, local conditions, and the farming calendar. They offer recommendations on crop varieties, ideal planting times, irrigation schedules, pest and disease management strategies, and even post-harvest techniques (Mamgai *et al.*, 2022). The impact of these Agromet Advisory Services has been monumental. Farmers who have embraced this information have reported increased crop yields, improved crop quality, and reduced input costs. Moreover, by aligning their farming activities with weather forecasts, they are better equipped to tackle climate-related risks and ensure more sustainable agricultural practices (Jagadeesha *et al.*, 2022).

The success of the DAMU Project's Agromet Advisory Services can be attributed not only to technological advancements but also to the collaborative efforts involving meteorologists, agricultural experts, government bodies, and local communities. It is a synergy that has brought about a positive change in the lives of countless farmers, fostering resilience and elevating their livelihoods (Kumar *et al.*, 2021). As the project continues to expand its reach, more farmers are embracing these weather-based recommendations, realizing that knowledge truly is the key to weathering the storms—both literal and metaphorical—that come their way. The fusion of meteorology and agriculture through the DAMU Project's Agromet Advisory Services is a beacon of hope for farmers in Western India. It signifies a shift towards smarter, more adaptive farming practices, ultimately paving the way for a more resilient and sustainable agricultural future (Ushasri *et al.*, 2022). In the present study we tried to study the functioning of Agromet Advisory Services under the DAMU project in the western states of India. Also an attempt has been made to examine the trends of Farmer Awareness Programmes conducted by DAMU KVKs over a period of time.

MATERIALS AND METHODS

Data related to DAMU centers and Dissemination of AAS (Agromet Advisory Services) in Western Region has been compiled from the annual report of ICAR-Agricultural Technology Application Research Institute (ATARI), Pune, 2022. Information related to number of villages covered and farmer awareness programme by the DAMU KVKs in Western India was compiled from various annual reports of ICAR-ATARI, Pune. The percentage of villages covered by DAMU KVKs was calculated based on the number of villages covered and total number of villages under jurisdiction of DAMU KVKs

Table 1. List of DAMU Centers in Western region of India

State	Number	Name of KVKs
Maharashtra	11	Amravati II, Aurangabad I, Bhandara, Buldhana II Gadchiroli, Nagpur I, Nandurbar, Osmanabad, Palghar Solapur II, Washim
Gujarat	9	Amreli, Dahod, Dang, Jamnagar, Narmada, Panchmahal, Surat, Vadodara, Valsad
Goa	1	North Goa

Source: Annual Report of ATARI, Pune (2022)

in the states of Maharashtra, Gujarat and Goa.

RESULTS AND DISCUSSION

District agro-meteorological unit (DAMU) centers in Western India

DAMU centers across Maharashtra, Gujarat and Goa stand as crucial pillars in the effort to bridge the gap between meteorology and agriculture, empowering farmers with valuable insights to enhance productivity, reduce risks associated with weather variability, and promote sustainable farming practices in the Western region of India.

Maharashtra hosts a total of 11 District Agro-Meteorological Unit (DAMU) Centers spread across various regions (Table 1). These centers play a pivotal role in providing localized weather-based agricultural advisories to assist farmers in making informed decisions regarding their agricultural practices. The DAMU centers in Maharashtra are strategically located in the districts Amravati, Aurangabad, Bhandara, Buldhana, Gadchiroli, Nagpur, Nandurbar, Osmanabad, Palghar, Solapur and Washim. Each of these centers serves as a hub for collecting meteorological data, analyzing weather patterns and disseminating tailored agro-advisories, thereby aiding farmers in optimizing their crop planning, irrigation scheduling, pest management, and other agricultural activities.

In Gujarat, there are a total of 9 District Agro-Meteorological Unit (DAMU) centers actively contributing to the agricultural sector by providing weather-based advisory services. These centers are strategically located in Amreli, Dahod, Dang, Jamnagar, Narmada, Panchmahal, Surat, Vadodara and Valsad district. The DAMU centers in Gujarat operate with a similar mandate as those in Maharashtra, leveraging meteorological data to generate location-specific agro-advisories. These advisories are instrumental in assisting farmers with critical information related to optimal planting times, suitable crop varieties, irrigation schedules and other farm management practices, aligning agricultural activities with prevailing weather conditions. Additionally, in the smaller state of Goa, there exists a single District Agro-Meteorological Unit (DAMU) center situated in North Goa. Despite being a compact region, this center serves the agricultural community by providing weather-related information and advisories tailored to the specific agricultural needs of the area.

Dissemination of AAS (Agromet Advisory Services)

The dissemination of Agromet Advisory Services (AAS)

showcases a detailed overview of the reach and impact of these services across different District Agro-Meteorological Units (DAMUs) in Maharashtra, Gujarat, and Goa.

In Maharashtra, various DAMU Units have effectively utilized WhatsApp groups for disseminating Agromet Advisory Services. Notably, units in Nandurbar, Osmanabad, Palghar, Buldhana II, Aurangabad I, Amravati II, Washim, Solapur II, Gadchiroli, Nagpur I, and Bhandara have collectively formed 1,167 WhatsApp groups. These groups have benefitted a substantial number of farmers, with 257,692 individuals receiving advisory services through WhatsApp. These efforts have covered 7,213 villages out of a total of 13,434 within DAMU jurisdictions in Maharashtra, highlighting the widespread outreach of these advisory services (Table 2).

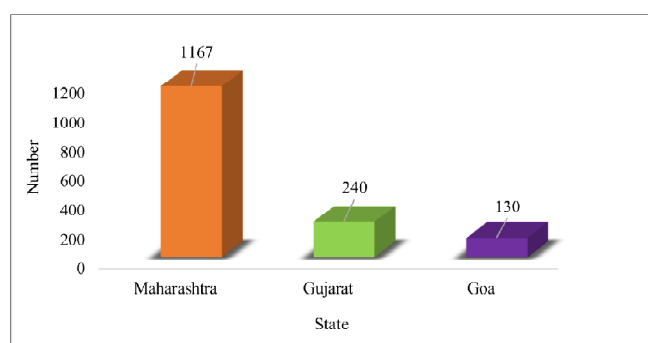
Similarly, in Gujarat, DAMU Units in Amreli, Narmada, Dang, Jamnagar, Dahod, Panchmahal, Surat, Vadodara, and Valsad have actively utilized 240 WhatsApp groups. These groups have facilitated advisory services reaching 31,332 farmers. This dissemination has extended to 2,822 villages out of a total of 6,207 villages under DAMU jurisdiction in Gujarat, showcasing a significant dissemination network in the state. In Goa's North Goa district, the DAMU Unit has employed 130 WhatsApp groups, benefiting 7,000 farmers across 196 villages out of a total of 216 villages in the region.

Collectively, across Maharashtra, Gujarat, and Goa, a total of 1,537 WhatsApp groups have been instrumental in providing Agromet Advisory Services. This effort has significantly impacted 296,024 farmers who have received valuable advisories through these platforms. The outreach spans across 10,231

villages out of a combined total of 19,857 villages within DAMU jurisdictions across the three states. The utilization of WhatsApp groups has emerged as a potent tool in disseminating Agromet Advisory Services, effectively reaching and benefiting a substantial number of farmers in the region, contributing to informed decision-making and enhanced agricultural practices.

Number of WhatsApp groups created by DAMU KVK in Western India

The number of WhatsApp groups established for agricultural communication and dissemination of information in Western India is shown in Figure 1. Maharashtra leads the region with a significant number of 1,167 WhatsApp groups created specifically for communication of Agromet Advisory



Source: Annual Report of ATARI, Pune (2022)

Fig. 1. Number of WhatsApp groups created by DAMU KVKs (As on March 2023)

Table 2. Dissemination of AAS (Agromet Advisory Services) as on March 2023

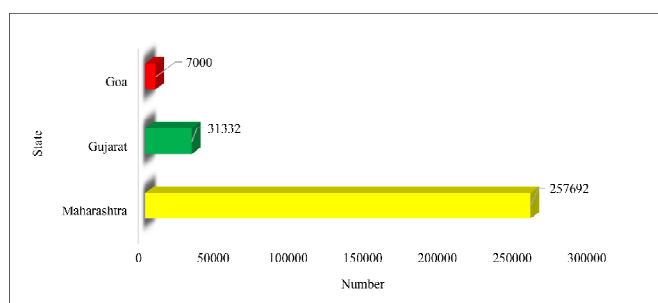
Sr. No.	State	DAMU unit name	No. of WhatsApp group	No. of Farmers benefited through whatsapp group	No of Villages covered	Total number of villages under DAMU jurisdiction
1	Maharashtra	Nandurbar	242	19427	653	931
2		Osmanabad	23	2548	48	622
3		Palghar	59	13295	702	1008
4		Buldhana II	57	8172	91	1502
5		Aurangabad I	16	42300	913	1362
6		Amravati II	180	39000	1245	1986
7		Washim	142	22160	385	760
8		Solapur II	64	14840	967	1152
9		Gadchiroli	105	52460	1250	1678
10		Nagpur I	246	38870	876	1617
11		Bhandara	33	4620	83	816
		Total	1167	257692	7213	13434
12	Gujarat	Amreli	18	2490	180	619
13		Narmada	16	3406	403	552
14		Dang	9	4322	273	311
15		Jamnagar	19	2904	375	677
16		Dahod	19	2248	237	723
17		Panchmahal	9	2000	150	607
18		Surat	18	2478	218	721
19		Vadodara	93	7876	570	1549
20		Valsad	39	3608	416	448
		Total	240	31332	2822	6207
21	Goa	North Goa	130	7000	196	216
		Grand total	1537	296024	10231	19857

Source: Annual Report of ATARI, Pune (2022)

information. In Gujarat, 240 WhatsApp groups dedicated to agricultural communication and information sharing, whereas Goa, being a smaller state, has established 130 WhatsApp groups tailored for agricultural communication.

Number of farmers benefited through whatsapp group created by DAMU KVK in Western India

The Figure 2 provides insights into the number of farmers benefiting from WhatsApp groups established for agricultural communication in different states across Western India. In Maharashtra, a substantial number of 257,692 farmers have benefited from WhatsApp groups. Similarly, 31,332 farmers have benefited from the agricultural WhatsApp groups in Gujarat, whereas despite being a smaller state, Goa has facilitated 7,000 farmers through WhatsApp groups

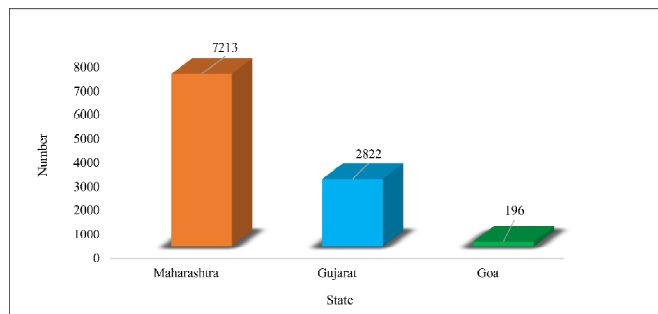


Source: Annual Report of ATARI, Pune (2022)

Fig. 2. Number of farmers benefited through whatsapp group (As on March 2023)

Number of villages covered by DAMU KVK in Western India

The number of villages covered by District Agro-Meteorological Unit (DAMU) Krishi Vigyan Kendras (KVKs) across Western India is shown in Figure 3. DAMU KVKs in Maharashtra have extended their services to cover a substantial count of 7,213 villages. Similarly, in Gujarat, DAMU KVKs have extended their coverage to 2,822 villages, whereas Goa, being a smaller state, has 196 villages covered by DAMU KVK.



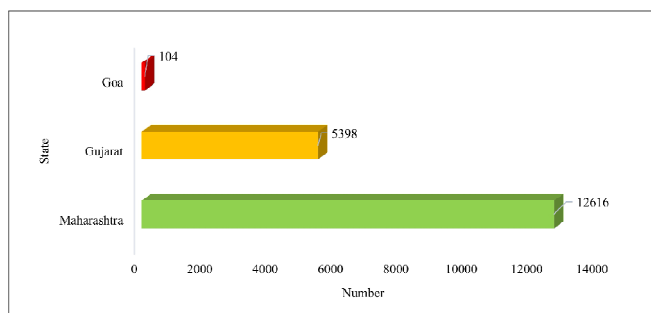
Source: Annual Report of ATARI, Pune (2022)

Fig. 3. Number of villages covered by DAMU KVKs in Western India (As on March 2023)

Number of Agro-Advisory bulletins prepared by DAMU KVK in Western India

Figure 4 provides a number of Agro-advisory bulletins prepared

DAMU KVKs in Western India, offering insight into the dissemination of agricultural information and advisories. In Maharashtra, a substantial 12,616 bulletins have been diligently prepared by DAMU KVKs. Similarly, DAMU KVKs have produced 5,398 bulletins, aiming to disseminate valuable agricultural knowledge to farmers across the Gujarat state. While Goa’s agricultural landscape is smaller compared to Maharashtra and Gujarat, DAMU KVKs in the state have prepared 104 bulletins.



Source: Annual Report of ATARI, Pune (2022)

Fig. 4. Number of agro-advisory bulletins prepared by DAMU KVKs (As on March 2023)

Percentage of villages covered by DAMU KVKs in Western region

Table 3 illustrates the percentage of villages covered by DAMU KVKs across between 2020 and 2022 in the Western region of India. In Maharashtra, the coverage by DAMU KVKs has seen a consistent increase over the years. In 2020, these KVKs covered 24% of the villages, which notably escalated to 51% in 2021, further rising to 54% in 2023. Similarly, in Gujarat, the coverage by DAMU KVKs has exhibited a notable ascent. Beginning at 23% coverage in 2020, it elevated to 38% in 2021 and further increased to 45% in 2023.

Contrastingly, Goa maintains a high percentage of village coverage by DAMU KVKs, consistently maintaining a coverage rate around 90% across the years 2020, 2021 and 2022. The collective coverage of villages by DAMU KVKs in the Western Region (Maharashtra, Gujarat, and Goa combined) has shown a steady increase. Starting at 46% in 2020, it progressed to 60% in 2021 and further advanced to 63% in 2022. This regional overview indicates the overall growth and effectiveness of DAMU KVKs in extending their services to a larger proportion of villages in the Western region.

Table 3. Percentage of villages covered by DAMU KVKs (in percentage)

States	2020	2021	2022
Maharashtra	24	51	54
Gujarat	23	38	45
Goa	90	90	91
Western Region	46	60	63

Source: Author’s calculation based on information from various annual reports of ATARI, Pune

Farmers awareness programmes (FAP) conducted by DAMU KVKs in Western India

Table 4 outlines the number of Farmers Awareness Programmes (FAP) conducted and the corresponding participant count across the region, specifically Maharashtra, Gujarat and Goa, showcasing the efforts to disseminate information and educate farmers about various agricultural practices and innovations.

Between 2020 and 2022, a total of 439 Farmers Awareness Programmes were conducted by DAMU KVKs, engaging a substantial number of participants totaling 716,314 in Maharashtra. Similarly, in Gujarat, 384 Farmers Awareness Programmes were organized, attracting 227,709 participants. In comparison to the larger states, one DAMU KVK of Goa conducted a 15 Farmers Awareness Programmes. Overall, across Maharashtra, Gujarat, and Goa, the Farmers Awareness Programmes have played a vital role in educating farmers about innovative practices, technology adoption, crop management, and sustainable agriculture.

Table 4. Number of Farmers Awareness Programmes (FAP) conducted and the corresponding participant by DAMU KVKs in Western India (2020 to 2022)

States	No. of Farmers Awareness Programme conducted	Number of Participants in FAP
Maharashtra	439	716314
Gujarat	384	227709
Goa	15	856

Source: Author’s calculation based on information from various annual reports of ATARI, Pune

CONCLUSION

The convergence of meteorology and agriculture within the DAMU Project’s Agromet Advisory Services illuminates a promising path for farmers across Western India. This synergy represents a move towards more intelligent and adaptable

farming methodologies. The pivotal role played by the Agromet Advisory Services, part of the DAMU Project in Western India, marks a ground-breaking transformation in agricultural approaches. Through the fusion of meteorological insights with farming techniques, this initiative substantially bolsters the socio-economic well-being of farmers, fostering a more robust and sustainable agricultural landscape. The DAMU centers across Maharashtra, Gujarat and Goa stand as crucial pillars in the effort to bridge the gap between meteorology and agriculture. Increase in number of DAMU centres in future will benefit for empowerment of farmers with valuable insights to enhance productivity, reduce risks associated with weather variability and promote sustainable farming practices in the Western region of India.

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