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Healthcare management practices adopted by dairy farmers in different agroclimatic zones of western Maharashtra

[1]Kalyankar BB, [1]Nande MP, [1]Kolhe SR, [1]Gondawane HR, [2]Doiphode AY, [3]Bhokre SM and [4]Bhalerao SM

[1]Department of Veterinary & A.H. Extension Education, Krantisinh Nana Patil College of Veterinary Science, Shirwal, Maharashtra, MAFSU, Nagpur, Maharashtra, India

[2]Department of Animal Genetics and Breeding, Krantisinh Nana Patil College of Veterinary Science, Shirwal, Maharashtra MAFSU, Nagpur, Maharashtra, India

[3]Department of Livestock Production Management, Krantisinh Nana Patil College of Veterinary Science, Shirwal, Maharashtra MAFSU, Nagpur, Maharashtra, India

[4]Department of Animal Nutrition, Krantisinh Nana Patil College of Veterinary Science, Shirwal, Maharashtra MAFSU, Nagpur, Maharashtra, India

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Corresponding Author: Nande MP

Abstract

This study analyzed socio-economic characteristics and healthcare management practices among dairy farmers across four agro-climatic zones (ACZ) in Western Maharashtra. A total of 240 dairy farmers from 24 villages, with 10 farmers from each village, were surveyed to explore their socio-economic conditions, and healthcare management practices adopted by dairy farmers. Most farmers showed medium levels of social participation, marginal landholdings, medium-sized herds, and moderate-income from dairy farming. Farmers typically had medium experience and relied primarily on agriculture. ACZ IV, however, exhibited significantly higher income levels, produced the highest milk yields, and had more experienced farmers. Dairy farming was increasingly becoming a primary livelihood, particularly in ACZ IV. In feeding practices, such as the use of concentrates and mineral mixtures, were widely adopted across all zones, with ACZ-II showing the highest adoption rates. In health management, ACZ-II had a high adoption of practices like feeding colostrum to newborn calves, vaccination, and deworming. ACZ-I universally adopted management practices, including washing the udder before and after milking. Other practices, like animal identification and shed cleaning, had high adoption rates in ACZ-I. ACZ-IV had a higher adoption rate for fodder preservation and regular deworming.

Keywords: Farmers, dairy, healthcare management practices, western Maharashtra, deworming

Introduction

Dairy farming plays a crucial role in India's agricultural economy, particularly for small and marginal farmers in rural areas. It offers a stable source of income in the face of uncertainties in crop production due to erratic weather, soil degradation, and limited land access (Brown, 2012) [1]. The livestock sector accounts for about 25% of the agricultural output and is growing faster than crop agriculture (Brown, 2012) [1]. India leads in global milk production, with output rising from 222.07 million tonnes in 2021-22 to 230.58 million tonnes in 2022-23 (Department of Animal Husbandry and Dairy, 2023) [2]. Effective dairy farming requires skilled management, particularly in breeding and healthcare practices, which directly affect productivity and animal welfare (Khode *et al*., 2017; Roy & Meena, 2020) [5, 8]. Key healthcare measures include vaccination, deworming, ectoparasite control, isolation of sick animals, and proper housing (Singh *et al*., 2007) [12]. These practices vary significantly across agro-climatic zones, making region-specific understanding essential for improving livestock outcomes (Gupta *et al*., 2008) [3]. Maharashtra, with its nine agro-climatic zones—including the Very High Rainfall Zone, Ghat Zone, Transition Zone, and Scarcity Zone in the western region—presents a diverse context for dairy farming. Socioeconomic conditions and gender roles, particularly the involvement of rural women, also influence healthcare practices (Kolstrup, 2016) [6].

Materials and Methods

The present *ex-post facto* study was conducted in the four agro-climatic zones of western Maharashtra, *i,e* High rainfall zone (ACZ I), Ghat Zone (ACZ II), transition Zone (ACZ III) and Scarcity Zone (ACZ IV). A multistage random sampling will be used for the present study, Six villages will be selected from each agro-climatic zone as per the intensity of the zone and 10 dairy farmer respondents will be randomly selected from each village, those having at least five dairy animals. Thus, a total of 240 respondents

will be selected for the study. A structured interview schedule by personal interview method will be used for data collection. Objective-oriented statements will be prepared, scrutinized, and reframed with the help of an expert and will be pretested. A pretested interview schedule will be used for data collection. Collected data will be coded, tabulated, and analysis will be done by using appropriate statistical tools.

Results and Discussion

Data in table 1 express in Distribution of dairy farmers according to socio-economic characteristics in different agro-climatic zones of Western Maharashtra indicated that majority of dairy farmers fall under the medium category in terms of social participation (77.91%), herd size (84.58%), income from dairy farming (82.50%), total annual income (82.50%), and experience in dairy farming (60.41%). Most farmers are marginal landholders (71.25%) with very few owning medium or large landholdings. In terms of milk production, the medium category again dominates (67.91%). The predominant occupation is agriculture (65.83%), followed by dairy farming (34.16%). This suggests that the majority of dairy farmers operate at a moderate level in terms of participation, resource holding, production, and income, with agriculture being their main occupation and dairy farming a secondary livelihood.

Data in table 2 express Distribution of dairy farmers according to the adoption of feeding management practices in different agro-climatic zones of western Maharashtra majority of dairy farmers widely adopted core feeding practices like feeding concentrates (95.41%), mineral mixtures (70%), and providing clean water (58.75%). Partial adoption was common for practices like chaffing fodder, feeding extra rations to pregnant animals, and to milch animals. Azolla cultivation saw the lowest adoption (87.08% non-adoption). Overall, while essential practices are well followed, there is significant scope to promote lesser-used practices like azolla cultivation and fodder preservation.

Cent percent of dairy farmers adopted feeding of concentrate in ACZ II, feeding of mineral mixture in ACZ II, provision of clean water to animals throughout the day in ACZ IV, and feeding of extra concentrate feed to milch animals in ACZ II, respectively. This finding is similar to Varaprasad (2013) [13] revealed that the majority of dairy farmers fully adopt the feeding of a concentrated mineral mixture followed by low and high.

Data in table 3 found in distribution of dairy farmers according to the adoption of health management practices in different agro-climatic zones of western Maharashtra revealed that dairy farmers show good adoption of key healthcare practices like colostrum feeding (86.66%), deworming (65%), vaccination (64.16%), and veterinary treatment (55.83%). Partial adoption is common for naval cord care, ecto-parasite control, and hygiene practices. Non-adoption is higher in placenta disposal (24.16%) and isolation of sick animals (14.58%). While core practices are well followed, lower mean scores for hygiene-related practices highlight the need for increased awareness and targeted training in disease prevention and sanitation.

The majority of farmers in ACZ IV had adopted cutting the naval cord and applying the tincture to newly born calves, 98.33percent of farmers adopted the practice of regular deworming in ACZ II, the majority of farmers that is 98.33 percent had adopted the practice of timely vaccination in ACZII, majority of farmers adopted 61.66 percent ectoparasite control ACZ I, majority 98.33 percent of farmers adopted practices of the feeding of colostrum to the newborn within 3 hours of birth ACZ II. This finding lines up with Manivannan and Mathialagan (2016) [7], Sharma (2023) [10], and Singh (2023) [11] revealed that the majority of dairy farmers adopted the practice of feeding colostrum, regular deworming, and vaccination, followed by low and high.

Data in table 4 reveals in adoption of management practices in different agro-climatic zones of western Maharashtra indicated that Partial adoption is common in grooming, shed cleaning, and animal identification. However, high non-adoption is seen in separate housing (70.83%), record-keeping, and use of government services (67.91%). While basic care is well managed, there are clear gaps in infrastructure, documentation, and service utilization that need attention.

The majority 68.33 per cent of farmers adopted management practices of identification of animals ACZ I, 81.66 per cent of farmers from the ACZ I had adopted cleaning of shed regularly, 95 per cent of farmers adopted washing of udder after milking ACZ III, 88.33 per cent of farmers adopted full hand milking ACZ III, 96.66 per cent of farmers never beat and freighting of animals during the milking in ACZ I and ACZ II, 75 per cent of farmers adopted the practice of fencing of the farm in ACZ II.

This finding is similar to Meena (2007) [8], Hossain (2005) [4], Rathore (2010) [9], and Pata (2018) revealed that the majority of farmers adopted the practice of full hand milking, washing of udder after milking, and cleaning of shed regularly, followed by low and high.

Table 5 express overall differential adoption of healthcare management practices in different agro-climatic zone indicated that the majority, 75 per cent, exhibited a moderate level of adoption of these practices. Conversely, only 10 per cent of farmers were classified in the high adoption category, signifying that they fully embraced healthcare management practices.

A averages for four different agroclimatic zones (ACZ I, ACZ II, ACZ III, and ACZ IV), along with their associated Critical Difference (CD) values. These averages reflect the performance of each agroclimatic zone. From the data, ACZ IV has the highest average, followed by ACZ III, ACZ I, and ACZ II, which indicates that ACZ IV has the best performance on average.

Table 1: Distribution of dairy farmers according to socio-economic characteristics in different agro-climatic zones of Western Maharashtra

Parameter	Category	Agro-climatic Zones				
		ACZ-I	ACZ-II	ACZ-III	ACZ-IV	Overall
Social participation	Low	00(00)	00(00)	16(26.66)	00(00)	16(6.66)
	Medium	44(73.33)	46(76.66)	44(73.33)	53(88.33)	187(77.91)
	High	16(26.66)	14(23.33)	00(00)	07(11.66)	37(15.41)
Landholding	Landless	00(00)	00(00)	00(00)	00(00)	00(00)
	Marginal	60(100)	54(90)	49(81.66)	08(13.33)	171(71.25)
	Small	00(00)	06(10)	10(16.66)	20(33.33)	36(15.00)
	Medium	00(00)	00(00)	01(01.66)	23(38.33)	24(10.00)
	Large	00(00)	00(00)	00(00)	09(15.00)	09(03.75)
Herd size	Low	04(06.66)	00(00)	04(06.66)	04(06.66)	12(05.00)
	Medium	48(80.00)	57(95.00)	50(83.33)	48(80.00)	203(84.58)
	High	08(13.33)	03(05.00)	06(10.00)	08(13.33)	25(10.41)
Income from dairy farming	Low	01(01.66)	04(6.66)	02(3.33)	04(06.66)	11(04.58)
	Medium	52(86.66)	47(78.33)	52(86.66)	47(78.33)	198(82.50)
	High	07(11.66)	09(15.00)	06(10)	09(15.00)	31(12.91)
Total annual income	Low	03(05.00)	04(06.66)	02(03.33)	05(08.33)	14(05.83)
	Medium	50(83.33)	50(83.33)	52(86.66)	46(76.66)	198(82.50)
	High	07(11.66)	06(10.00)	06(10.00)	09(15.00)	28(11.66)
Milk production	Low	43(71.66)	00(00)	02(03.33)	01(01.66)	46(19.16)
	Medium	10(16.66)	54(90.00)	52(86.66)	47(78.33)	163(67.91)
	High	07(11.60)	06(10.00)	06(10.00)	12(20.00)	31(12.91)
Experience in dairy farming	Low	12(20.00)	13(21.66)	12(20.00)	07(11.66)	44(18.33)
	Medium	32(53.33)	34(56.66)	36(60.00)	43(71.66)	145(60.41)
	High	16(26.66)	13(21.66)	12(20.00)	10(16.66)	51(21.25)
Occupation	Dairy	17(28.33)	12(20.00)	21(35.00)	32(53.33)	82(34.16)
	Agriculture	43(71.66)	48(80.00)	39(65.00)	28(46.66)	158(65.83)
	Business	00(00)	00(00)	00(00)	00(00)	00(00)
	Services	00(00)	00(00)	00(00)	00(00)	00(00)

(Figure in parenthesis expressed in percentage),
Adopted, PA- Partially Adopted, and NA- Not Adopted)
ACZ I: High rainfall Zone, ACZ II: Ghat Zone, ACZ III: Transition Zone, ACZ IV: Scarcity Zone

Table 2: Distribution of dairy farmers according to the adoption of feeding management practices in different agro-climatic zones of western Maharashtra.

S.N	Practices	Category	ACZ-I	ACZ-II	ACZ-III	ACZ-IV	Overall
Feeding practices							
1	Chaffing of green fodder	A	02(3.33)	11(18.33)	57(95)	09(15)	79(32.91)
		PA	43(71.66)	44(73.33)	02(3.33)	51(85)	140(58.33)
		NA	15(25)	05(8.33)	01(1.66)	00(00)	21(8.75)
	Mean		0.78	1.1	1.93	1.15	1.24
2	Feeding of concentrates	A	58(96.66)	60(100)	53(88.33)	58(96.66)	229(95.41)
		PA	02(3.33)	00(00)	06(10)	02(3.33)	10(4.16)
		NA	00(00)	00(00)	01(1.66)	00(00)	01(0.41)
	Mean		1.96	2	1.86	1.96	1.95
3	Feeding of mineral mixtures	A	48(80)	60(100)	03(05)	57(95)	168(70)
		PA	12(20)	00(00)	27(45)	02(3.33)	41(17.08)
		NA	00(00)	00(00)	30(50)	01(1.66)	31(12.91)
	Mean		1.8	2	0.55	1.93	1.57
4	Cultivation of azolla	A	00(00)	00(00)	00(00)	02(3.33)	02(0.83)
		PA	01(1.66)	03(05)	13(21.66)	12(20)	29(12.08)
		NA	59(98.33)	57(95)	47(78.33)	46(76.66)	209(87.08)
	Mean		0.016	0.05	0.21	0.26	0.13
5	Fodder preservation through hay or silage making	A	00(00)	03(05)	19(31.66)	53(88.33)	75(31.25)
		PA	45(75)	57(95)	24(40)	06(10)	132(55)
		NA	15(25)	00(00)	17(28.33)	01(1.66)	33(13.75)
	Mean		0.75	1.05	1.03	1.86	1.17

6	Feeding of extra ration to pregnant animals	A	03(05)	04(6.66)	36(60)	13(21.66)	56(23.33)
		PA	57(95)	05(8.33)	23(38.33)	47(78.33)	132(55)
		NA	00(00)	51(85)	01(1.66)	00(00)	52(21.66)
	Mean		1.05	0.21	1.58	1.21	1.01
7	Feeding of extra concentrates to milch animals	A	32(53.33)	05(8.33)	36(60)	14(23.33)	87(36.25)
		PA	27(45)	55(91.66)	24(40)	46(76.66)	152(63.33)
		NA	01(1.66)	00(00)	00(00)	00(00)	1(0.41)
	Mean		1.51	1.08	1.6	1.23	1.35
8	Availability of ad libitum clean water	A	36(60)	06(10)	49(81.66)	50(83.33)	141(58.75)
		PA	23(38.33)	54(90)	10(16.66)	10(16.66)	97(40.41)
		NA	01(1.66)	00(00)	01(1.66)	00(00)	02(0.83)
	Mean		1.58	1.1	1.8	1.83	1.57

(Figure in parenthesis expressed in percentage), Adopted, PA- Partially Adopted, and NA- Not Adopted) ACZ I: High rainfall Zone, ACZ II: Ghat Zone, ACZ III: Transition Zone, ACZ IV: Scarcity Zone

Table 3: Distribution of dairy farmers according to the adoption of health management practices in different agro-climatic zones of western Maharashtra.

Sr. No	Dairy farming practices	Category	ACZ-I	ACZ-II	ACZ-III	ACZ-IV	Overall
B	**Health Management practices**						
1	Cutting of naval cord and applying tincture to newly born calves	A	00(00)	03(05)	26(43.33)	46(76.66)	75(31.25)
		PA	34(56.66)	57(95)	34(56.66)	14(23.33)	139(57.91)
		NA	26(43.33)	00(00)	00(00)	00(00)	26(10.83)
	Mean		0.56	1.05	1.43	1.76	1.20
2	Regular Deworming	A	32(53.33)	59(98.33)	32(53.33)	33(55)	156(65)
		PA	28(46.66)	01(1.66)	27(45)	27(45)	83(34.58)
		NA	00(00)	00(00)	01(1.66)	00(00)	01(0.41)
	Mean		1.53	1.98	1.51	1.55	1.64
3	Timely Vaccination	A	16(26.66)	59(98.33)	39(65)	40(66.66)	154(64.16)
		PA	43(71.66)	01(1.66)	20(33.33)	20(33.33)	84(35)
		NA	01(1.66)	00(00)	01(1.66)	00(00)	02(0.833)
	Mean		1.25	1.98	1.63	1.66	1.63
4	Ectoparasitic control	A	37(61.66)	05(8.33)	16(26.66)	35(58.33)	93(38.75)
		PA	23(38.33)	55(91.66)	43(71.66)	25(41.66)	146(60.83)
		NA	00(00)	00(00)	01(1.66)	00(00)	01(0.41)
	Mean		1.61	1.08	1.25	1.58	1.38
5	Feeding of colostrum to the newborn within 3 hours of birth	A	52(86.66)	59(98.33)	54(90)	43(71.66)	208(86.66)
		PA	08(13.33)	01(1.66)	06(10)	17(28.33)	32(13.33)
		NA	00(00)	00(00)	00(00)	00(00)	00(00)
	Mean		1.86	1.98	1.9	1.71	1.86
6	Isolation of sick animals from healthy animals	A	29(48.33)	00(00)	16(26.66)	20(33.33)	65(27.08)
		PA	25(41.66)	57(95)	18(30)	40(66.66)	140(58.33)
		NA	06(10)	03(05)	26(43.33)	00(00)	35(14.58)
	Mean		1.38	0.95	0.83	1.33	1.12
7	Placenta disposal practice	A	30(50)	00(00)	05(8.33)	32(53.33)	67(27.91)
		PA	29(48.33)	41(68.33)	17(28.33)	28(46.66)	115(47.91)
		NA	01(1.66)	19(31.66)	38(63.33)	00(00)	58(24.16)
	Mean		1.48	0.68	0.45	1.53	1.03
8	Carcass disposal procedure	A	23(38.33)	04(6.66)	43(71.66)	41(68.33)	111(46.25)
		PA	33(55)	32(53.33)	14(23.33)	19(31.66)	98(40.83)
		NA	04(6.66)	24(40)	03(05)	00(00)	31(12.91)
	Mean		1.31	0.66	1.66	1.68	1.33
9	Treatment by a qualified veterinarian	A	12(20)	07(11.66)	32(53.33)	48(80)	99(41.25)
		PA	43(71.66)	52(86.66)	27(45)	12(20)	134(55.83)
		NA	05(8.33)	01(1.66)	01(1.66)	00(00)	07(2.91)
	Mean		1.11	1.1	1.51	1.8	1.38

(Figure in parenthesis expressed in percentage),
Adopted, PA- Partially Adopted, and NA- Not Adopted)
ACZ I: High rainfall Zone, ACZ II: Ghat Zone, ACZ III: Transition Zone, ACZ IV: Scarcity Zone

Table 4: Distribution of dairy farmers according to the adoption of management practices in different agro-climatic zones of western Maharashtra.

Sr. No	Dairy farming practices	Category	ACZ-I	ACZ-II	ACZ-III	ACZ-IV	Overall
C	Management practices						
1	Identification of animals	A	41(68.33)	15(25)	36(60)	31(51.66)	123(51.25)
		PA	19(31.66)	40(66.66)	17(28.33)	29(48.33)	105(43.75)
		NA	00(00)	05(8.33)	07(11.66)	00(00)	12 (05)
	Mean		1.68	1.16	1.48	1.51	1.46
2	Cleaning of animal sheds regularly.	A	49(81.66)	07(11.66)	28(46.66)	16(26.66)	100(41.66)
		PA	11(18.33)	47(78.33)	23(38.33)	39(65)	120(50)
		NA	00(00)	06(10)	09 (15)	05 (8.33)	20(8.33)
	Mean		1.81	1.01	1.31	1.18	1.33
3	Separate housing for animals	A	02(3.33)	02(3.33)	04(6.66)	02(3.33)	10(4.16)
		PA	26(43.33)	02(3.33)	18(30)	14(23.33)	60(25)
		NA	32(53.33)	56(93.33)	38(63.33)	44(73.33)	170(70.83)
	Mean		0.5	0.1	0.43	0.3	0.33
4	Washing of animal before milking	A	28(46.66)	04(6.66)	18(30)	02(3.33)	52(21.66)
		PA	11(18.33)	31(51.66)	10(16.66)	17(28.33)	69(28.75)
		NA	21(35)	25(41.66)	32(53.33)	41(68.33)	119(49.58)
	Mean		1.11	0.65	0.76	0.35	0.72
5	Washing of hand and udder before milking	A	60(100)	31(51.66)	56(93.33)	44(73.33)	191(79.58)
		PA	00(00)	29(48.33)	03(05)	16(26.66)	48(20)
		NA	00(00)	00(00)	01(1.66)	00(00)	01(0.41)
	Mean		2	1.51	1.91	1.73	1.79
6	Washing of udder after milking	A	37(61.66)	31(51.66)	57(95)	43(71.66)	168(70)
		PA	01(1.66)	22(36.66)	02(3.33)	17(28.33)	42(17.5)
		NA	22(36.66)	07(11.66)	01(1.66)	00(00)	30(12.5)
	Mean		1.25	1.4	1.93	1.71	1.57
7	Full hand milking	A	49(81.66)	37(61.66)	53(88.33)	42(70)	181(75.41)
		PA	10(16.66)	22(36.66)	06(10)	18(30)	56(23.33)
		NA	01(1.66)	01(1.66)	01(1.66)	00(0)	03(1.25)
	Mean		1.8	1.6	1.86	1.7	1.74
8	Grooming facility at the farm	A	02(3.33)	10(16.66)	16(26.66)	14(23.33)	42(17.5)
		PA	50(83.33)	42(70)	22(36.66)	25(41.66)	139(57.91)
		NA	08(13.33)	08(13.33)	22(36.66)	21(35)	59(24.58)
	Mean		0.9	1.03	0.9	0.88	0.92
9	Not beating and freighting the animals during milking.	A	58(96.66)	53(88.33)	24(40)	58(96.66)	193(80.41)
		PA	02(3.33)	07(11.66)	16(26.66)	02(3.33)	27(11.25)
		NA	00(00)	00(00)	20(33.33)	00(00)	20(8.33)
	Mean		1.96	1.88	1.06	1.96	1.72
10	Fencing at the farm	A	16(26.66)	45(75)	27(45)	25(41.66)	113(47.08)
		PA	35(58.33)	14(23.33)	19(31.66)	28(46.66)	96(40)
		NA	09(15)	01(1.66)	14(23.33)	07(11.66)	31(12.91)
	Mean		1.11	1.73	1.21	1.3	1.34
11	Restriction of outsiders to enter the farm	A	05(8.33)	12(20)	25(41.66)	24(40)	66(27.5)
		PA	18(30)	39 (65)	19(31.66)	16(26.66)	92(38.33)
		NA	37(61.66)	09(15)	16(26.66)	20(33.33)	82(34.16)
	Mean		0.46	1.05	1.15	1.06	0.93
12	Maintain dairy farm records	A	02(3.33)	01(1.66)	17(28.33)	22(36.33)	42(17.5)
		PA	48(80)	15(25)	27(45)	13(21.66)	103(42.91)
		NA	10(16.66)	44(73.33)	16(26.66)	25(41.66)	95(39.58)
	Mean		0.86	0.28	1.01	0.95	0.77
13	Use of Govt. Animal Health Care Services	A	00(00)	08(13.33)	01(1.66)	01(1.66)	10(4.16)
		PA	27(45)	17(28.33)	03(05)	20(33.33)	67(27.91)
		NA	33(55)	08(13.33)	56(93.33)	39(65)	163(67.91)
	Mean		0.45	0.55	0.08	0.36	0.36

(Figure in parenthesis expressed in percentage),
Adopted, PA- Partially Adopted, and NA- Not Adopted)
ACZ I: High rainfall Zone, ACZ II: Ghat Zone, ACZ III: Transition Zone, ACZ IV: Scarcity Zone

Table 5: Distribution of dairy farmers according to their adoption of healthcare management practices

Parameter	Category	Agro-climatic Zones				
		ACZ-I	ACZ-II	ACZ-III	ACZ-IV	Overall
Adoption of healthcare management practices	Low	09(15)	06(10)	12(20)	09(15)	36(15)
	Medium	45(75)	49(81.66)	40(66.66)	46(76.66)	180(75)
	High	06(10)	05(8.33)	08(13.33)	05(8.33)	24(10)
	Mean ±SD	37.53±4.6	34.0±5.38	37.93±6.2	41.44±3.90	37.66±5.6

(Figure in parenthesis expressed in percentage),
Adopted, PA- Partially Adopted, and NA- Not Adopted)
ACZ I: High rainfall Zone, ACZ II: Ghat Zone, ACZ III: Transition Zone, ACZ IV: Scarcity Zone

Conclusion

The study reveals that dairy farming in Western Maharashtra is marked by moderate socioeconomic status and adoption of healthcare and feeding management, yet substantial gaps remain in the adoption of advanced and sustainable practices. Among the agro-climatic zones, ACZ-IV demonstrated superior performance in feeding and healthcare practices, while ACZ-II lagged significantly, highlighting regional disparities.

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