



Factsheet 9: Technology Adoption

Background

In the previous factsheet, costs, revenue and profit were considered across the four districts. In this factsheet, the characteristics of the IndoDairy Smallholder Household Survey (ISHS) will be further studied, focusing on what technologies were used by dairy farmers in West Java and how these contributed to on farm productivity and milk quality.

The dairy farmers were asked a series of questions to understand the level of adoption of dairy farming technologies on farm. Farmers were asked a series of questions for 27 technologies and based on responses, were categorised under one of the adoption statuses for each technology:

1. Unaware
2. Aware, but not adopted
3. Stopped adoption (disadoption)
4. Still using (continued adoption)

The process for categorising farmers' responses is illustrated in Figure 1.

This information gives us a sound understanding of the extent of outreach and adoption of many improved management practices for dairy farming. The different categories help identify the necessary

intervention to improve the adoption of the technology. For instance, technologies which have low awareness initially require communication and training activities, while technologies which have high rates of discontinuation require additional consideration as to why farmers are not using it – such as accessibility issues, cost of adoption is high.

An overview of this data is presented in Table A1 in the Appendix and in Figure 2.

Overview of ISHS results

Technologies with low awareness

The overall results indicate that a high percentage of farmers were unaware of certain dairy farm technologies. These technologies included:

- Synchronisation estrus (91%), nutrient feed blocks (87%), milk pasteurisation (74%), UHT (Ultra High Temperature) (72%).

It is interesting to note that there was a fairly high percentage of farmers who were unaware of certain basic dairy farm technologies that are critical to ensure dairy productivity and quality.

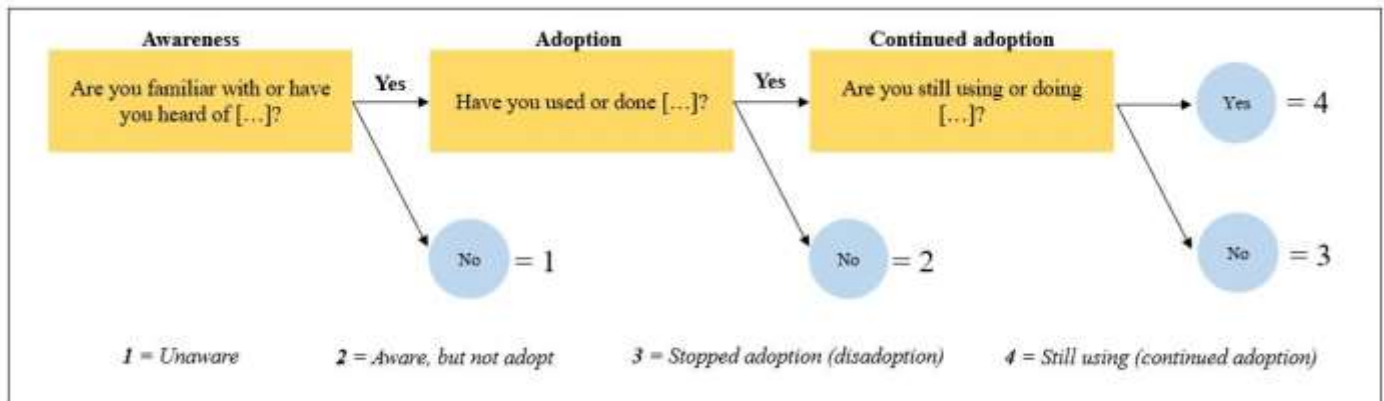


Figure 1. Categories based on adoption decisions.

These technologies included:

- Mastitis test (63%), high protein concentrates (62%), record keeping (56%), application of breeding plan (55%) and feeding legume forages (51%).

There were significant differences across districts with respect to awareness about certain technologies. District wise results of technology awareness are shown in Table A2 in the Appendix and in Figure 3.

- The share of farmers who were aware about high protein concentrates (16% or higher) was highest in Cianjur district (60%) and lowest in Garut district (22%).
- Overall, only 58% of the farmers were aware about teat dipping after milk. Of these, the share of farmers who were aware was lowest in Garut district (35%) and highest in Bandung district (72%).
- Similarly, the share of farmers who were aware about stainless steel milking equipment was the lowest in Garut district (64%) compared to other districts.

It was interesting to note that the **level of awareness about majority of the technologies was generally lowest in Garut district** as compared to the other districts.

Technologies with low adoption

The dairy farmer respondents were asked, of the technologies that they were aware of, had they ever used any of them on the farm, to get insights on technologies with low adoption. The

district wise results are shown in Table A3 in the Appendix and in Figure 4.

- Overall results indicate that the technology, which had the highest percentage of farmers being aware but not adopted, was automatic milking machines (74%).
- Other technologies like biogas tanks (65%), manure processing/manure re-use (58%), cooling milk in water tanks (56%), milk quality testing (53%) also had a high percentage where farmers were aware of but had not adopted these technologies on farm.

There were significant differences across districts with respect to adoption about certain technologies.

- It is noteworthy that, overall of the farmers that were aware about mastitis tests, only about half (50%) of the farmers had ever used mastitis tests. Of these, the share of farmers from Cianjur district was the lowest (32%).
- Similar observations were noted with the use of high protein concentrates, with overall of the farmers that were aware of high protein concentrates only 48% had ever used it on farm. Of these, the highest use was observed in Bogor district (61%) and lowest in Garut district (32%).

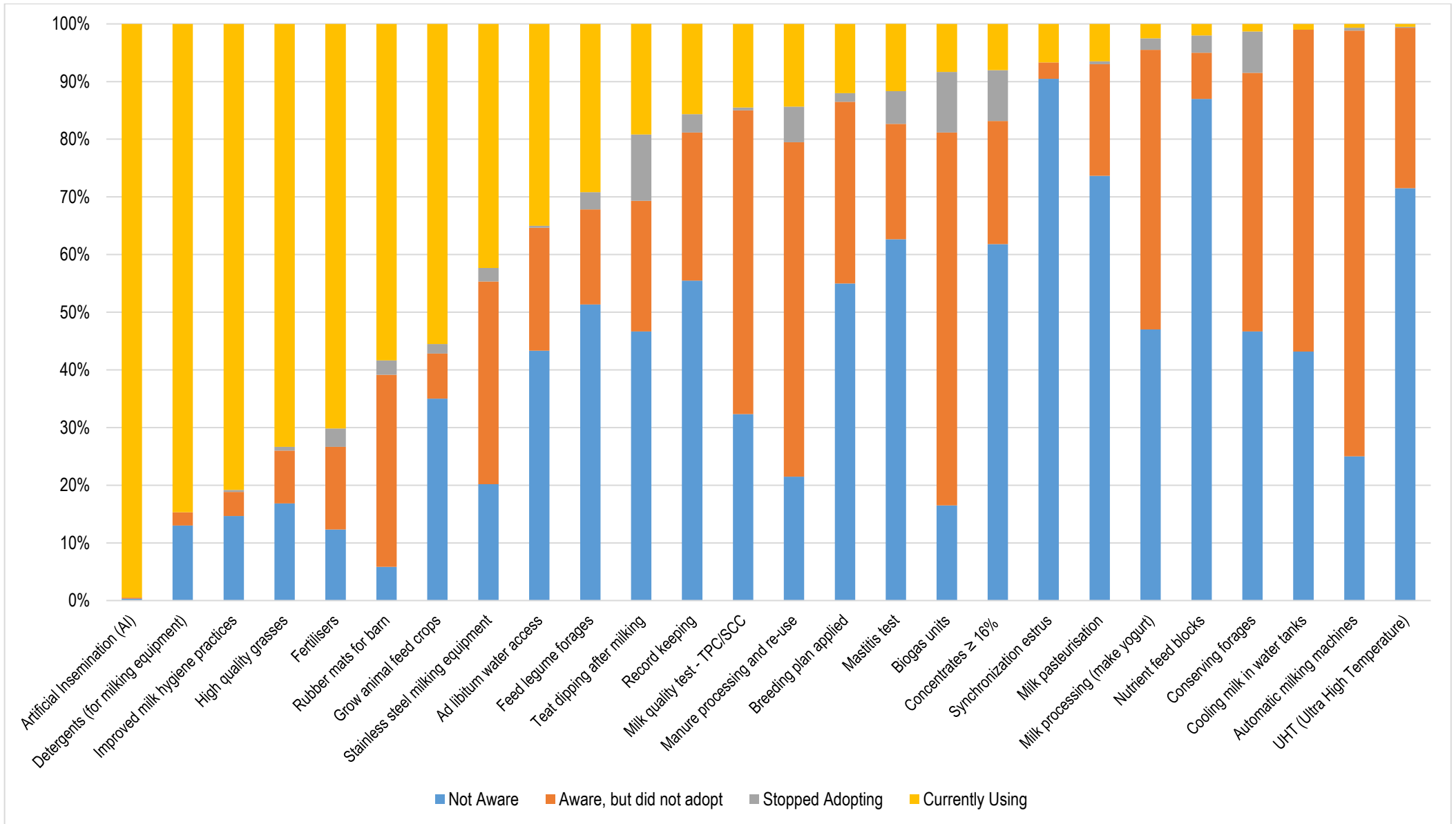


Figure 2. Adoption decisions of dairy technologies in Indonesian smallholder dairy farmers.

- With respect to usage of feed legume forages, of the farmers that were aware of this, 67% had used this on farm. The differences between usages of feed legume forages were significant across the four districts, with higher share of farmers from districts of Bogor (81%) and Garut (86%), on the other hand, lower share of usage in farmers from Cianjur (64%) and Bandung (46%) district.

A high percentage of use of some technologies was noted in farmers across the four districts that reported to be aware of these technologies. These included:

- Use of high-quality grasses (89%), growing animal feed crops (88%), fertiliser uses for growing grass (84%), use of detergents for milking equipment (97%) and improving milking hygiene to reduce Total Plate Count (TPC) (95%).

On the other hand, for some technologies a lower percentage of use was noted across the four districts. These technologies included:

- Application of breeding plan (31%), manure processing/re-use (29%), biogas units (28%), milk pasteurisation (28%), conserving forages for the dry season (22%), milk quality tests to determine Total Plate Count/Somatic Cell Count (23%), milk processing (10%), cooling milk in water tanks (2%) and automatic milking machines (2%).

Technologies that farmers stopped using

For the farmers who answered that they were aware of certain technologies and had ever used them on their farm, they were then asked if they had used these technologies since 2014 to get insights on technologies which farmers stopped using or disadopted on their dairy farms. The results are shown in Table A4 in the Appendix and in Figure 5.

- **It is interesting to note that overall, about 12% of the farmers had stopped teat dipping after milking, a critical practice from preventing occurrence of mastitis.**

- About 11% of farmers had stopped using high protein concentrates to feed their dairy cattle.

For technologies that farmers had used since 2014, there were no significant differences across the four districts for the following technologies:

- Mastitis tests (86%), usage of high protein concentrates (86%), usage of feed legume forages (97%), use of high quality grasses (99%), teat dipping after milking (86%), improving drinking water availability 24/7 (99%), using detergents for milking equipment (99%), improving milk hygiene to reduce TPC (99%), nutrient feed blocks (83%), cooling milk in water tanks (100%), stainless steel milking equipment (99%), milk pasteurisation (91%), milk processing (87%), milk quality testing (98%), synchronisation of oestrus (93%) and manure processing (85%).

On the other hand, significant differences across the four districts were noted in regard to some technologies that farmers reported to have stopped using since 2014.

- Almost all farmers from Bandung (98%), Bogor (100%) and Cianjur (100%) districts used rubber/plastic floor for the barn cage but only 67% of farmers from Garut district reported to have used this since 2014.
- Similarly, with regards to record keeping, the share of farmers keeping records since 2014 was higher in Bandung (93%), Bogor (93%) and Cianjur (96%) districts as compared to Garut district (67%).
- On the other hand, the share of farmers using biogas units since 2014 was higher in Bogor (88%), Cianjur (100%) and Garut districts (91%) as compared to Bandung where only 58% of farmers had used biogas units since 2014.

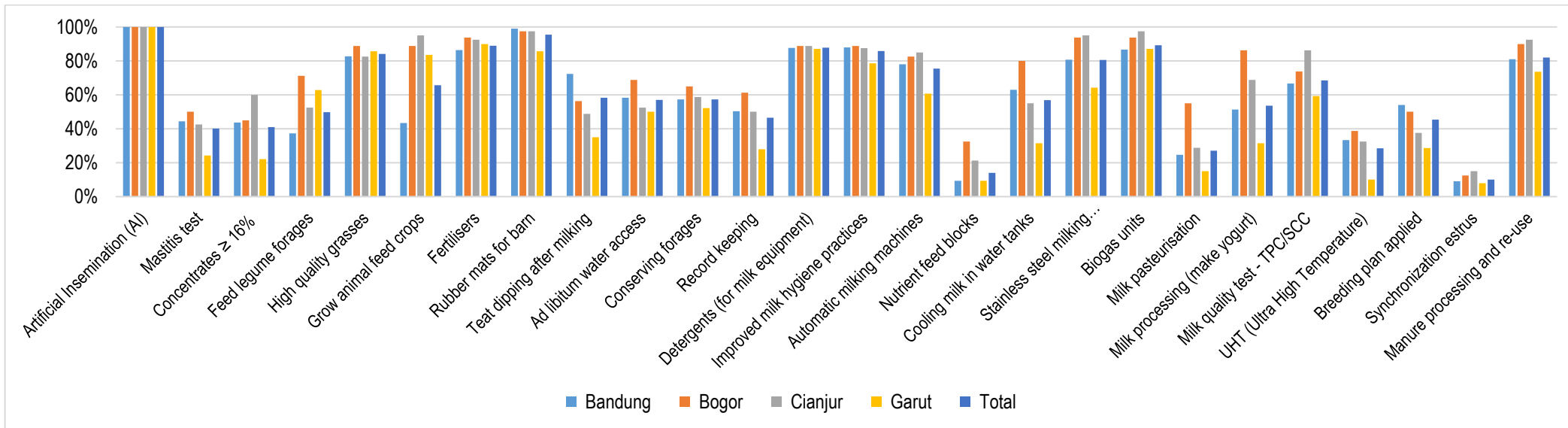


Figure 3. Awareness of technologies among dairy farmers.

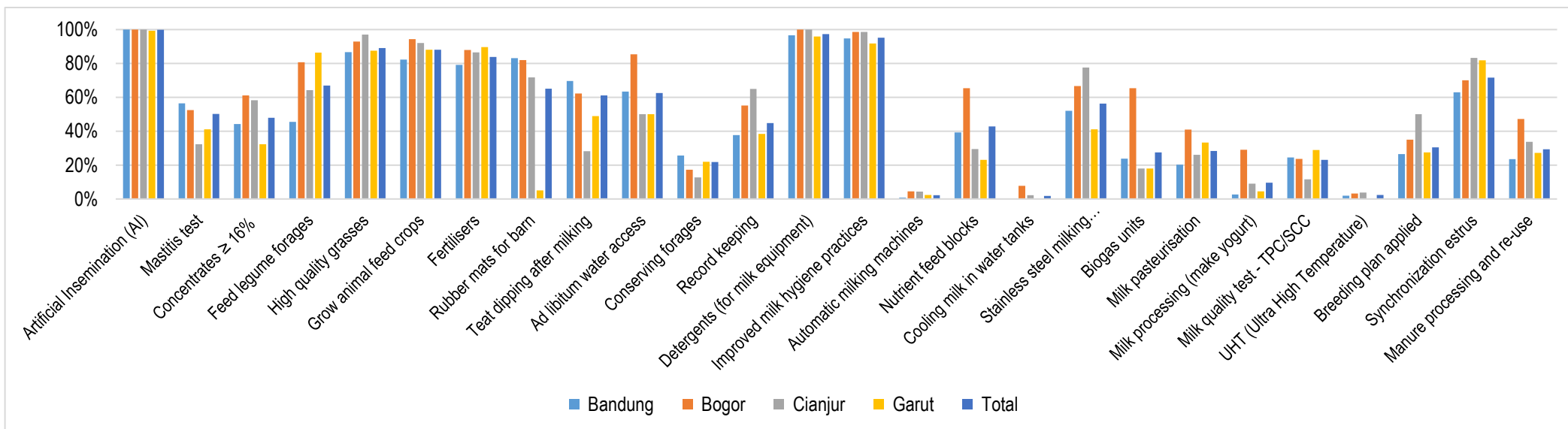


Figure 4. Technologies that have ever been used by dairy farmers.

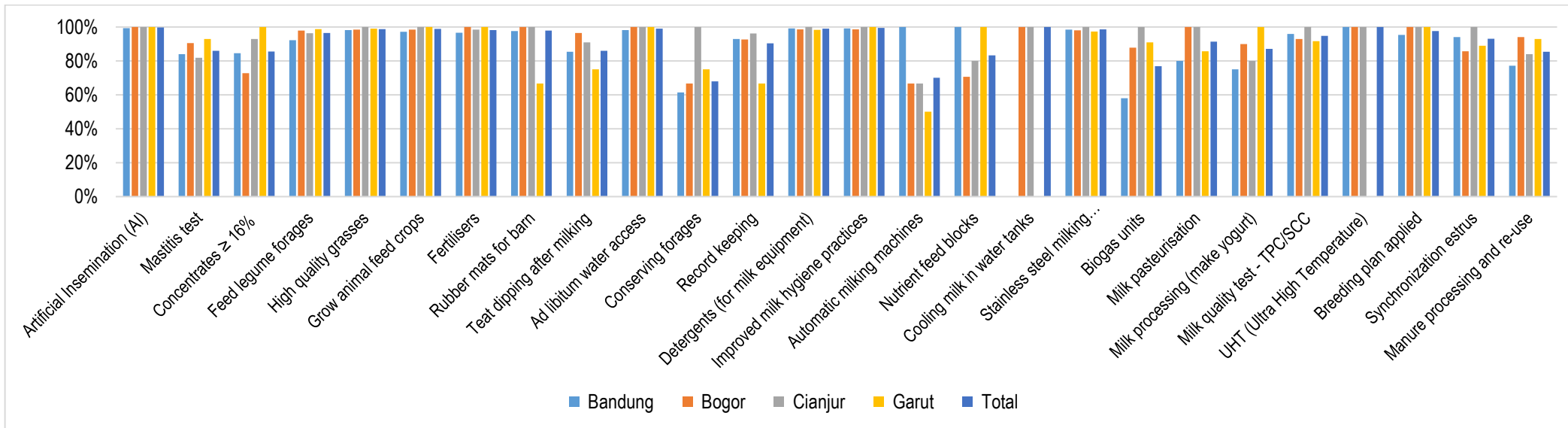


Figure 5. Technologies used since 2014 by dairy farmers.

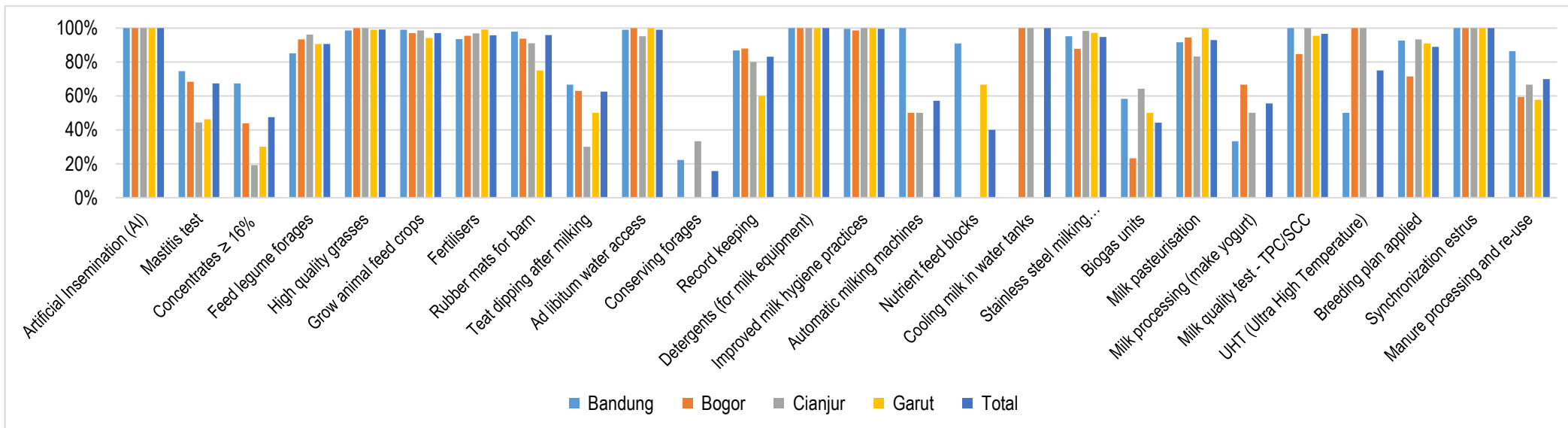


Figure 6. Technologies currently used on farm by dairy farmers.

Currently used technologies

The final question in the series of questions on technology uses, as shown in Figure 1, was if the farmers were using certain technologies at the time of the survey. This question was asked to the farmers only if they reported to be aware of these technologies, had ever used them and had used them since 2014. The district wise results are shown in Table A5 in the Appendix and in Figure 6.

A high percentage of farmers continued to use some of the basic but critical technologies on their dairy farms including:

- Artificial insemination (100%), using detergents for milking equipment (85%), improving milk hygiene to reduce TPC (81%), use of high-quality grasses (73%), use of fertilisers to grow grass (70%), rubber/plastic floor for barn/cage (58%) and growing animal feed crops (56%).

It is interesting to note that only a fewer number of farmers continued to use some critical technologies that are essential for production efficiency and ensuring product quality.

- This included teat dipping after milking (19%), record keeping (16%), milk quality testing (15%), application of breeding plan (12%), mastitis test (12%).
- Only few farmers used complex technologies like milk pasteurisation (7%), milk processing (3%), cooling milk in water tanks (1%), automatic milking machines (0.67%) and UHT (Ultra High Temperature) (0.50%).
- Of the technologies that farmers reported to have used since 2014, the technologies that continue to being used at the time of the survey were, artificial insemination (100%), using detergent for milking equipment (100%), use of high quality grasses (99%), growing animal feed crops (97%), use of fertilisers for grass (96%), rubber/plastic floor for barn cage (96%), improving milk hygiene to reduce TPC (100%), stainless steel milking equipment (95%).

There were significant differences across districts with regards to some technologies continuously being used by dairy farmers.

- Overall, 48% of farmers indicated that they used high protein concentrates at the time of the survey with the highest share of farmers using this technology observed in Bandung district (67%) and lowest in Cianjur (19%).
- Significant difference was noted with the use of rubber/plastic floor for the barn/cage with farmers from Bandung (98%), Bogor (94%) and Cianjur (91%) reporting high levels of adoption while only 75% of farmers from Garut were using this technology at the time of the survey.
- Overall, 44% of farmers were using biogas units at the time of the survey, with the lowest usage reported in Bogor district (23%) and the highest in Cianjur district (64%).

Summary

Technologies with low awareness

- Only a fewer number of farmers had heard about or were aware of technologies like **synchronization of estrus, nutrient feed blocks, milk pasteurisation and UHT (Ultra High Temperature).**
- A fairly high percentage of farmers were unaware of certain basic dairy farm technologies that are critical to ensure dairy productivity and quality like **Mastitis test (63%), high protein concentrates (62%), record keeping (56%), application of breeding plan (55%) and feeding legume forages (51%).**

Technologies with low adoption

- Technologies with a high percentage of awareness but low levels of adoption included **automatic milking machines (74%), biogas tanks (65%), manure processing/manure re-use (58%), cooling milk in water tanks (56%), milk quality testing (53%).**

Technologies with discontinued adoption

- **Overall, about 12% of the farmers had stopped teat dipping after milking, a critical practice from preventing occurrence of mastitis.**
- **About 11% of farmers had stopped using high protein concentrates to feed their dairy cattle.**

Technologies with high continued adoption

- **A high percentage of farmers continued to use some of the basic but critical technologies on their dairy farms including artificial insemination (100%), using detergents for milking equipment (85%), improving milk hygiene to reduce TPC (81%), use of high-quality grasses (73%), use of fertilisers to grow grass (70%), rubber/plastic floor for barn/cage (58%) and growing animal feed crops (56%).**

Further understanding of the level of awareness and current usage patterns of dairy farm technologies will pave the way for design and implementation of extension programs targeted at knowledge dissemination and capacity building of smallholder dairy farmers.

The following factsheet, Factsheet 10, provides information on attitudes, future aspirations and perceptions of dairy farmers in the ISHS across the four districts.

Appendix to Factsheet 9

The tables included in this Appendix provide summary statistics related to technology adoption for the entire sample grouped by districts. Standard deviations (SD) are included where relevant.

Statistical significance between districts were determined using ANOVA (for binary and continuous variables) and Pearson's Chi-squared test (for categorical variables). For categorical variables with small observations ($n < 5$), Fisher's exact test was used to confirm the Chi-squared test. ANOVA and Chi-squared tests results are shown in the right-hand column, under the Total. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant ($p < 0.10$). Districts with the same letter are not significantly different at the 5% level ($p > 0.05$).

Table A1. Overview of dairy farm technology adoption of the ISHS (n=600).

Dairy Technologies	Not Aware¹	Aware, but not adopted²	Stopped adopting³	Still Using⁴
Artificial Insemination (AI)	0.3%	0.2%	0.0%	99.5%
Using detergents for milking equipment	13.0%	2.3%	0.0%	84.7%
Improved milking hygiene to reduce TPC	14.7%	4.2%	0.3%	80.8%
Use of high-quality grasses	16.8%	9.2%	0.7%	73.3%
Use of fertiliser to grow grass	12.3%	14.3%	3.2%	70.2%
Rubber/Plastic floor for the barn/cage	5.8%	33.3%	2.5%	58.3%
Grow animal feed crops	35.0%	7.8%	1.7%	55.5%
Stainless steel milking equipment	20.2%	35.2%	2.3%	42.3%
Improving drinking water availability 24/7	43.3%	21.3%	0.3%	35.0%
Feed legume forages (e.g. Leucaena)	51.3%	16.5%	3.0%	29.2%
Teat dipping after milking	46.7%	22.7%	11.5%	19.2%
Record keeping	55.5%	25.7%	3.2%	15.7%
Milk quality test	32.3%	52.7%	0.5%	14.5%
Manure processing / manure re-use	21.5%	58.0%	6.2%	14.3%
Breeding plan applied	55.0%	31.5%	1.5%	12.0%
Mastitis test	62.7%	20.0%	5.7%	11.7%
Biogas units	16.5%	64.7%	10.5%	8.3%
High protein concentrates (16% or higher)	61.8%	21.3%	8.8%	8.0%
Synchronization estrus	90.5%	2.8%	0.0%	6.7%
Milk pasteurisation	73.7%	19.3%	0.5%	6.5%
Milk processing (make yogurt)	47.0%	48.5%	2.0%	2.5%
Nutrient feed blocks	87.0%	8.0%	3.0%	2.0%
Conserving forages for the dry seasons (hay, silage)	46.7%	44.8%	7.2%	1.3%
Cooling milk in water tanks	43.2%	55.8%	0.0%	1.0%
Automatic milking machines	25.0%	73.8%	0.5%	0.7%
UHT (Ultra High Temperature)	71.5%	27.8%	0.2%	0.5%

¹Not aware – the value shows the percentage of farmers not aware or have never heard about the technology; ²Aware, but not adopted – the value shows the percentage of farmers aware of the technology but have not adopted on the farm; ³Stopped adopting – the value shows the percentage of farmers that have stopped adopting or stopped using certain technologies on farm; ⁴Still Using – the value shows the percentage of farmers still using certain technologies at the time of the survey

Table A2. Technologies by level of awareness in dairy farmers (n=600).

Variables	Bandung		Bogor		Cianjur		Garut		Total	
	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²
Have you heard about the technology? (n=600)										
<i>Artificial Insemination (AI)</i>	100.0%		100.0%		100.0%		100.0%		100.0%	
<i>Mastitis test</i>	44.3%	a	50.0%	a	42.5%	a	24.3%		40.2%	***
<i>High protein concentrates (16% or higher)</i>	43.7%	a	45.0%	ab	60.0%	b	22.1%		41.0%	***
<i>Feed legume forages (e.g. Leucaena)</i>	37.3%	a	71.3%	b	52.5%	ab	62.9%	b	49.8%	***
<i>Use of high-quality grasses</i>	82.7%		88.8%		82.5%		85.7%		84.2%	
<i>Grow animal feed crops</i>	43.3%		88.8%	a	95.0%	a	83.6%	a	65.7%	***
<i>Use of any fertilisers for the grass</i>	86.3%		93.8%		92.5%		90.0%		89.0%	
<i>Rubber/Plastic floor for the barn/cage</i>	99.0%	a	97.5%	a	97.5%	a	85.7%		95.5%	***
<i>Teat dipping after milking</i>	72.3%		56.3%	b	48.8%	ab	35.0%	a	58.3%	***
<i>Improving drinking water availability 24/7</i>	58.3%	ab	68.8%	b	52.5%	ab	50.0%	a	57.0%	**
<i>Conserving forages for the dry seasons (hay, silage)</i>	57.3%		65.0%		58.8%		52.1%		57.3%	
<i>Record keeping</i>	50.3%	a	61.3%	a	50.0%	a	27.9%		46.5%	***
<i>Using detergents for milking equipment</i>	87.7%		88.8%		88.8%		87.1%		87.8%	
<i>Improved milking hygiene to reduce TPC</i>	88.0%	b	88.8%	ab	87.5%	ab	78.6%	a	85.8%	**
<i>Automatic milking machines</i>	78.0%	a	82.5%	a	85.0%	a	60.7%		75.5%	***
<i>Nutrient feed blocks</i>	9.3%	a	32.5%	c	21.3%	bc	9.3%	ab	14.0%	***
<i>Cooling milk in water tanks</i>	63.0%	a	80.0%		55.0%	a	31.4%		56.8%	***
<i>Stainless steel milking equipment</i>	80.7%		93.8%	a	95.0%	a	64.3%		80.5%	***
<i>Biogas units</i>	86.7%	a	93.8%	ab	97.5%	b	87.1%	ab	89.2%	**
<i>Milk pasteurisation</i>	24.7%	a	55.0%		28.8%	a	15.0%	a	27.0%	***
<i>Milk processing (make yogurt)</i>	51.3%		86.3%	a	68.8%	a	31.4%		53.7%	***
<i>Milk quality test - TPC/SCC</i>	66.7%	a	73.8%	ab	86.3%	b	59.3%	a	68.5%	***
<i>UHT (Ultra High Temperature)</i>	33.3%	a	38.8%	a	32.5%	a	10.0%		28.5%	***
<i>Breeding plan applied</i>	54.0%	c	50.0%	bc	37.5%	ab	28.6%	a	45.3%	***
<i>Synchronization estrus</i>	9.0%		12.5%		15.0%		7.9%		10.0%	
<i>Manure processing / manure re-use</i>	81.0%	ab	90.0%	b	92.5%	b	73.6%	a	82.0%	***

¹Value is a percentage; ²Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Districts with the same letter are not significantly different at the 5% level (p > 0.05).

Table A3. Technologies adopted by dairy farmers.

Variables	Bandung		Bogor		Cianjur		Garut		Total	
	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²
Have you ever used the technology?										
<i>Artificial Insemination (AI) (n=600)</i>	100.0%		100.0%		100.0%		99.3%		99.8%	
<i>Mastitis test (n=241)</i>	56.4%	a	52.5%	a	32.4%	a	41.2%	a	50.2%	*
<i>High protein concentrates (16% or higher) (n=246)</i>	44.3%	a	61.1%	a	58.3%	a	32.3%	a	48.0%	**
<i>Feed legume forages (e.g. Leucaena) (n=299)</i>	45.5%	a	80.7%	bc	64.3%	ab	86.4%	c	66.9%	***
<i>Use of high-quality grasses (n=505)</i>	86.7%	a	93.0%	a	97.0%	a	87.5%	a	89.1%	*
<i>Grow animal feed crops (n=394)</i>	82.3%	a	94.4%	a	92.1%	a	88.0%	a	88.1%	**
<i>Use of any fertilisers for the grass (n=534)</i>	79.2%	a	88.0%	ab	86.5%	ab	89.7%	b	83.9%	**
<i>Rubber/Plastic floor for the barn/cage (n=573)</i>	83.2%	a	82.1%	a	71.8%	a	5.0%		65.1%	***
<i>Teat dipping after milking (n=350)</i>	69.6%	c	62.2%	bc	28.2%	a	49.0%	ab	61.1%	***
<i>Improving drinking water availability 24/7 (n=342)</i>	63.4%	a	85.5%		50.0%	a	50.0%	a	62.6%	***
<i>Conserving forages for the dry seasons (hay, silage) (n=344)</i>	25.6%		17.3%		12.8%		21.9%		21.8%	
<i>Record keeping (n=279)</i>	37.7%	a	55.1%	ab	65.0%	b	38.5%	ab	44.8%	***
<i>Using detergents for milking equipment (n=527)</i>	96.6%		100.0%		100.0%		95.9%		97.3%	
<i>Improved milking hygiene to reduce TPC (n=515)</i>	94.7%	a	98.6%	a	98.6%	a	91.8%	a	95.1%	*
<i>Automatic milking machines (n=453)</i>	0.9%		4.5%		4.4%		2.4%		2.2%	
<i>Nutrient feed blocks (n=84)</i>	39.3%	a	65.4%	a	29.4%	a	23.1%	a	42.9%	**
<i>Cooling milk in water tanks (n=341)</i>	0.0%	a	7.8%	b	2.3%	ab	0.0%	a	1.8%	***
<i>Stainless steel milking equipment (n=483)</i>	52.1%	ab	66.7%	bc	77.6%	c	41.1%	a	56.3%	***
<i>Biogas units (n=535)</i>	23.8%	a	65.3%		17.9%	a	18.0%	a	27.5%	***
<i>Milk pasteurisation (n=162)</i>	20.3%		40.9%		26.1%		33.3%		28.4%	
<i>Milk processing (make yogurt) (n=322)</i>	2.6%	a	29.0%		9.1%	a	4.5%	a	9.6%	***
<i>Milk quality test - TPC/SCC (n=411)</i>	24.5%	a	23.7%	a	11.6%	a	28.9%	a	23.1%	*
<i>UHT (Ultra High Temperature) (n=171)</i>	2.0%		3.2%		3.8%		0.0%		2.3%	
<i>Breeding plan applied (n=272)</i>	26.5%	a	35.0%	a	50.0%	a	27.5%	a	30.5%	*
<i>Synchronization estrus (n=60)</i>	63.0%		70.0%		83.3%		81.8%		71.7%	
<i>Manure processing / manure re-use (n=492)</i>	23.5%	a	47.2%	b	33.8%	ab	27.2%	a	29.3%	***

¹Value is a percentage; ²Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Districts with the same letter are not significantly different at the 5% level (p > 0.05).

Table A4. Technology disadoption since 2014 by dairy farmers.

Variables	Bandung		Bogor		Cianjur		Garut		Total	
	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²
Have you used this technology since 2014?										
<i>Artificial Insemination (AI) (n=599)</i>	99.3%		100.0%		100.0%		100.0%		99.7%	
<i>Mastitis test (n=121)</i>	84.0%		90.5%		81.8%		92.9%		86.0%	
<i>High protein concentrates (16% or higher) (n=118)</i>	84.5%		72.7%		92.9%		100.0%		85.6%	
<i>Feed legume forages (e.g. Leucaena) (n=200)</i>	92.2%		97.8%		96.3%		98.7%		96.5%	
<i>Use of high-quality grasses (n=450)</i>	98.1%		98.5%		100.0%		99.0%		98.7%	
<i>Grow animal feed crops (n=347)</i>	97.2%		98.5%		100.0%		100.0%		98.8%	
<i>Use of any fertilisers for the grass (n=448)</i>	96.6%	a	100.0%	a	98.4%	a	100.0%	a	98.2%	*
<i>Rubber/Plastic floor for the barn/cage (n=373)</i>	97.6%	a	100.0%	a	100.0%	a	66.7%		97.9%	***
<i>Teat dipping after milking (n=214)</i>	85.4%		96.4%		90.9%		75.0%		86.0%	
<i>Improving drinking water availability 24/7 (n=214)</i>	98.2%		100.0%		100.0%		100.0%		99.1%	
<i>Conserving forages for the dry seasons (hay, silage) (n=75)</i>	61.4%		66.7%		100.0%		75.0%		68.0%	
<i>Record keeping (n=125)</i>	93.0%	a	92.6%	a	96.2%	a	66.7%		90.4%	***
<i>Using detergents for milking equipment (n=513)</i>	99.2%		98.6%		100.0%		98.3%		99.0%	
<i>Improved milking hygiene to reduce TPC (n=490)</i>	99.2%		98.6%		100.0%		100.0%		99.4%	
<i>Automatic milking machines (n=10)</i>	100.0%		66.7%		66.7%		50.0%		70.0%	
<i>Nutrient feed blocks (n=36)</i>	100.0%		70.6%		80.0%		100.0%		83.3%	
<i>Cooling milk in water tanks (n=6)</i>	.		100.0%		100.0%		.		100.0%	
<i>Stainless steel milking equipment (n=272)</i>	98.4%		98.0%		100.0%		97.3%		98.5%	
<i>Biogas units (n=147)</i>	58.1%		87.8%	a	100.0%	a	90.9%	a	76.9%	***
<i>Milk pasteurisation (n=46)</i>	80.0%		100.0%		100.0%		85.7%		91.3%	
<i>Milk processing (make yogurt) (n=31)</i>	75.0%		90.0%		80.0%		100.0%		87.1%	
<i>Milk quality test - TPC/SCC (n=95)</i>	95.9%		92.9%		100.0%		91.7%		94.7%	
<i>UHT (Ultra High Temperature) (n=4)</i>	100.0%		100.0%		100.0%		.		100.0%	
<i>Breeding plan applied (n=83)</i>	95.3%		100.0%		100.0%		100.0%		97.6%	
<i>Synchronization estrus (n=43)</i>	94.1%		85.7%		100.0%		88.9%		93.0%	
<i>Manure processing / manure re-use (n=144)</i>	77.2%	a	94.1%	a	84.0%	a	92.9%	a	85.4%	*

¹Value is a percentage; ²Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Districts with the same letter are not significantly different at the 5% level (p > 0.05).

Table A5. Technologies currently being used by dairy farmers.

Variables	Bandung		Bogor		Cianjur		Garut		Total	
	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²	Value ¹	Sig ²
Are you currently using the technology?										
Artificial Insemination (AI) (n=597)	100.0%		100.0%		100.0%		100.0%		100.0%	
Mastitis test (n=104)	74.6%	a	68.4%	a	44.4%	a	46.2%	a	67.3%	*
High protein concentrates (16% or higher) (n=101)	67.3%	b	43.8%	ab	19.2%	a	30.0%	ab	47.5%	***
Feed legume forages (e.g. Leucaena) (n=193)	85.1%		93.3%		96.2%		90.7%		90.7%	
Use of high-quality grasses (n=444)	98.6%		100.0%		100.0%		99.0%		99.1%	
Grow animal feed crops (n=343)	99.0%		97.0%		98.6%		94.2%		97.1%	
Use of any fertilisers for the grass (n=440)	93.4%		95.5%		96.8%		99.1%		95.7%	
Rubber/Plastic floor for the barn/cage (n=365)	97.9%	a	93.8%	a	91.1%	a	75.0%	a	95.9%	**
Teat dipping after milking (n=184)	66.7%	a	63.0%	a	30.0%	a	50.0%	a	62.5%	*
Improving drinking water availability 24/7 (n=212)	99.1%		100.0%		95.2%		100.0%		99.1%	
Conserving forages for the dry seasons (hay, silage) (n=51)	22.2%		0.0%		33.3%		0.0%		15.7%	
Record keeping (n=113)	86.8%		88.0%		80.0%		60.0%		83.2%	
Using detergents for milking equipment (n=508)	100.0%		100.0%		100.0%		100.0%		100.0%	
Improved milking hygiene to reduce TPC (n=487)	99.6%		98.6%		100.0%		100.0%		99.6%	
Automatic milking machines (n=7)	100.0%		50.0%		50.0%		0.0%		57.1%	
Nutrient feed blocks (n=30)	90.9%	b	0.0%	a	0.0%	a	66.7%	b	40.0%	***
Cooling milk in water tanks (n=6)	0.0%		100.0%		100.0%		0.0%		100.0%	
Stainless steel milking equipment (n=268)	95.2%	a	87.8%	a	98.3%	a	97.2%	a	94.8%	*
Biogas units (n=113)	58.3%	b	23.3%	a	64.3%	b	50.0%	ab	44.2%	***
Milk pasteurisation (n=42)	91.7%		94.4%		83.3%		100.0%		92.9%	
Milk processing (make yogurt) (n=27)	33.3%		66.7%		50.0%		0.0%		55.6%	
Milk quality test - TPC/SCC (n=90)	100.0%	b	84.6%	a	100.0%	ab	95.5%	ab	96.7%	**
UHT (Ultra High Temperature) (n=4)	50.0%		100.0%		100.0%		0.0%		75.0%	
Breeding plan applied (n=81)	92.7%		71.4%		93.3%		90.9%		88.9%	
Synchronization estrus (n=40)	100.0%		100.0%		100.0%		100.0%		100.0%	
Manure processing / manure re-use (n=123)	86.4%	a	59.4%	a	66.7%	a	57.7%	a	69.9%	**

¹Value is a percentage; ²Sig = Significance; * p < 0.10, ** p < 0.05 and *** p < 0.01 indicate significance at the 10%, 5% and 1% levels, respectively. Pairwise comparisons were performed for continuous and binary variables using Tukey tests when the ANOVA test was trending towards significant (p < 0.10). Districts with the same letter are not significantly different at the 5% level (p > 0.05).