Effect of Extension Program on Improving Farmers' Knowledge in the Narrowing Coastal Area of Segara Anakan Lagoon, Indonesia

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ABSTRAK

Sulastri E, Triatmojo A, A'yun AQ, Tatipikalawan JM. 2024. Pengaruh program penyuluhan terhadap peningkatan pengetahuan peternak di wilayah pesisir penyempitan Laguna Segara Anakan, Indonesia. JITV 29(3):161-171. DOI:http://dx/doi .org/10.14334/jitv.v29.i3.3391.

Sedimentasi Laguna Segara Anakan menyebabkan banyak masyarakat di Kampung Laut meninggalkan profesi nelayan dan memulai profesi lain untuk menyambung hidup. Beternak domba menjadi alternatif profesi baru sebagai sumber pendapatan keluarga. Program penyuluhan merupakan salah satu upaya untuk membantu masyarakat beradaptasi dan meningkatkan pengetahuan mereka terhadap profesi baru tersebut. Penelitian ini bertujuan untuk menganalisis pengaruh penyuluhan terhadap peningkatan pengetahuan peternak tentang praktek pengawetan hijauan dan pencegahan penyakit scabies. Wawancara dilakukan pada 215 peternak untuk mengetahui peningkatan pengetahuan peternak yang dihitung menggunakan skor saat melakukan pretest sebelum dan post-test setelah program penyuluhan dilakukan. Uji T dilakukan untuk menganalisis perbedaan tingkat pengetahuan peternak sebelum dan sesudah kegiatan penyuluhan. Faktor yang mempengaruhi peningkatan pengatahuan diuji dengan analisis regresi, dimana variabel independent meliputi karakteristik peternak. Hasil penelitian menunjukkan bahwa sebelum dilakukan penyuluhan, peternak memiliki tingkat pengetahuan yang rendah terkait pengawetan hijauan dan pencegahan penyakit scabies, dan terdapat kecenderungan bahwa terjadi peningkatan jumlah peternak yang memiliki level pengetahuan tinggi. Peningkatan pengetahuan tentang pencegahan penyakit scabies lebih tinggi dibandingkan pengetahuan tentang pengawetan hijauan ($P\leq0,01$). Tingginya indeks pengetahuan peternak tentang pencegahan penyakit scabies disebabkan karena peternak tidak memiliki pengetahuan sebelumnya terkait penyakit scabies. Pendidikan peternak dan pengalaman beternak domba berpengaruh nyata terhadap pengetahuan peternak tentang pengawetan hijauan ($P\leq0,01$ dan $P\leq0,05$). Penelitian ini juga menemukan bahwa usia peternak berpengaruh terhadap pengetahuan peternak tentang pencegahan penyakit scabies ($P\leq0,10$). Dapat disimpulkan bahwa pengetahuan peternak tentang pengawetan hijauan dan pencegahan penyakit scabies menjadi lebih baik setelah mengikuti program penyuluhan.

Kata Kunci: Penyuluhan, Peternak, Pengawetan Hijauan, Pencegahan Penyakit Scabies

ABSTRACT

Sulastri E, Triatmojo A, A'yun AQ, Tatipikalawan JM. 2024. Effect of extension program on improving farmers' knowledge in the narrowing Segara Anakan Lagoon coastal area in Indonesia. JITV 29(3):161-171. DOI:http://dx/doi.org/10.14334/jitv.v29.i3.3391.

Segara Anakan Lagoon sedimentation has caused many people in Kampung Laut to change their profession from fishery and start other profession to survive. Sheep farming became an alternative to generate the family income. The extension program is one of the efforts to adapt and improve farmers' knowledge regarding sheep farming. This study aimed to analyze the effect of extension on improving the knowledge of farmers. The study instrument were used to measure the knowledge level of farmers was a questionnaire of pretest and post-test. Respondents were ramdomly sampled resulting in 215 farmers who participated in extension program. The differences of the farmers' knowledge level before and after extension program implemented were analized using t-test. Multiple regression analysis were carried out to determine the effect of characteristics on farmers' knowedge. Results showed that before the extension program was running no farmers had sufficient knowledge of forage preservation and scabies prevention. The trend indicated that the number of farmers with a high level of knowledge increased after the extension intervention. Improving knowledge on scabies prevention was higher than forage preservation ($P\leq0.01$). Farmers' education and experience in sheep farming significantly influenced their knowledge on forage preservation ($P\leq0.01$ and $P\leq0.05$). This study also found that farmers' age would affect their knowledge on scabies prevention ($P\leq0.10$). It can be concluded that farmers' knowledge on forage preservation and scabies prevention improved after participating in the extension program.

Key Words: Extension, Farmers, Forage Preservation, Scabies Prevention

INTRODUCTION

The Segara Anakan area is an estuarine lagoon composed of several ecosystems that are tightly interconnected and located in the Central Java Province, Indonesia. The Segara Anakan Lagoon plays a vital role in the productivity of Java south coastal waters. Biological resources inside the lagoon can provide a livelihood for the locals in the form of brackish fishery (Sanjatmiko 2021; Sulastri et al. 2020). Therefore, fishing is the main source of income for the locals who live near the coast. However, this ecosystem is undertreated by continuing sedimentations.

The white areas in Figure 1 indicate land or sedimentation that keeps expanding every year, whereas the grey area represents the water of Segara Anakan Lagoon that keeps decreasing. The reduction of the wet area caused by sedimentation in 38 years, from 1978 to 2016, is 2703.7 ha, and the rate of land formation is 71.15 ha per year (Rose et al. 2016). The sedimentation rate in Segara Anakan Lagoon during the dry season is 0.067 m/s, which increases to 1.61 m/s during the rainy season (Ihsan et al. 2018). The material flowing from the Citanduy river at a rate of 7.4 million tonnes per year allows for an expansion in the sedimentation area (Sari et al. 2016).

Nevertheless, given the evident continuous sedimentation in Segara Anakan Lagoon, many of these locals have been compelled to seek alternative employments outside fishing. Residents should consider additional employment because they can no longer rely on fishing for a living. Sheep farming is a new enterprise that has greatly aided the livelihood of locals (Hegde 2019).

Most of the sheep farming in the study region is conducted by smallholder farmers with limited access to information, experience and economic resources because livestock is a recent activity for them. Hence, farmers need assistance from institutions that are reliable and accessible (Gayatri et al. 2016). Extension could provide a strategy by transferring relevant knowledge and technology to farmers (Masephula & Olorunfemi 2023; Rokhani et al. 2021). It is also a process that provides lessons to farmers. In the context of the learning process, extension aims to change the knowledge, skill and attitude of farmers.

The extension programme should be customised to the problems and needs of the community. In this study, extension programme's issues are determined on the basis of field circumstances, in which sheep's average daily gain is low. A lack of knowledge in animal feed technologies, such as silage and hay production, is found based on observations from focused group discussions. Furthermore, scabies is frequently found in Segara Anakan Lagoon, which is often neglected by farmers because the disease does not cause harm to livestock.

Acceptance of cultural and technological changes on rural farms is essential for greater agricultural productivity. Thus, farmers have no alternative apart from learning and implementing scientific agricultural techniques to substitute their traditional methods (Umeh et al. 2018). Farmers' reluctance to respond favourably to new innovations or technologies might cause delayed developments in agriculture (Etwire et al. 2017).

In introducing innovations, farmers tend to seek the success of a programme rather than the process (Jost et al. 2016). The extension can be provided as a systematic process to help farmers analyse their present and expected future situations, become aware of their problems and increase their knowledge. For example, upon acquiring specific knowledge related to certain problems through extension, farmers can find solutions and consequences and act on possible alternatives (Skaalsveen et al. 2020).

The level of farmers' knowledge on potential hazards of the disease is important in preventing outbreaks (Hundal et al. 2016). The need for training interventions to increase awareness on disease and health risks (Qui et al. 2024). A serious education mobilisation should be initiated immediately in cooperation with various institutions to educate farmers and increase their awareness about the issue (Robertson 2020).

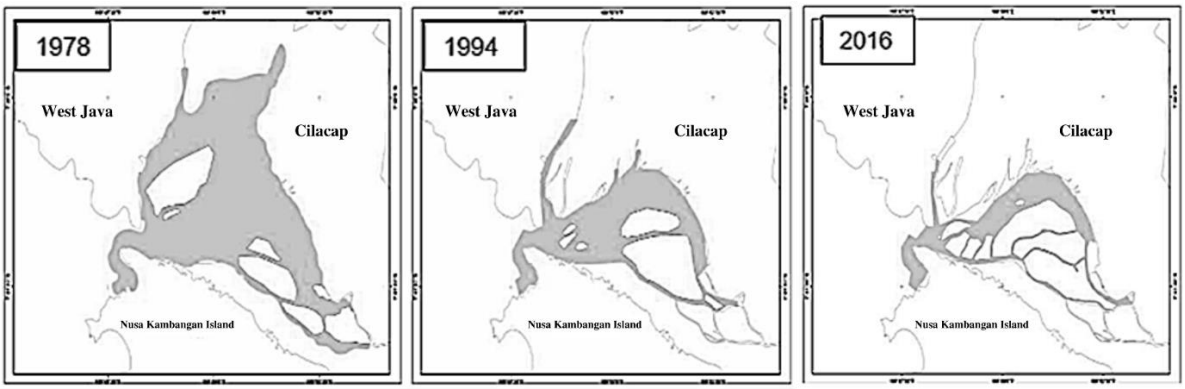

Figure 1. Changes in land profiles of Segara Anakan Lagoon (images processed from multi-temporal land satellite (Rose et al. 2016)

In addition, the level of farmers' knowledge is frequently distinctive, as each individual has distinct characteristics and expectations. The level of knowledge improvement is influenced by farmers' socioeconomic characteristics (Triveni et al. 2018; Xu & Zhang 2021). Hence, understanding how farmers' knowledge levels differ is critical, and the extension may achieve the best possible knowledge improvement by tailoring the content and delivery methods of information on good or modern agricultural practices in a specific area.

In assessing the performance of the extension programme, the improvement and factors that affect the knowledge level about sheep farming must be determined. Knowledge improvement can be determined by conducting pre-tests and post-tests on the extension process (Hosking et al. 2015). However, farmers' characteristics are considered as factors that affect the improvement of their level of knowledge. Hence, this paper discusses the effect of extension on improving the knowledge of farmers on forage preservation and scabies prevention.

MATERIALS AND METHODS

Research design

The study was carried out as descriptive methodology, to describe, explore, records and interprets conditions that exist. The data on farmers' knowledge were collected from before and after extension program conducted. The extension programme was a package of result demonstration and group discussions regarding sheep farming practices on forage preservation and scabies prevention (De Jesus & Buenas 2023).

Selection of sample

The study was conducted in 2023 at Kampung Laut Sub-district, Cilacap Regency, Central Java Province, Indonesia (Figure 2). A random sampling design was used to select a sample of 215 farmers who raise fewer than 20 heads of sheep. The sample size was determined on the basis of the participation of the farmers in the extension programme. A total of 215 farmers intensively participated in the extension programme on forage preservation and scabies prevention in sheep farming practices. These issues were determined on the basis of the analyses of needs at the stage of analysing learners through observations of sheep farming practices currently conducted by farmers.

Assessment of knowledge score

A lack of knowledge in animal feed technologies, such as silage and hay production, is found based on observations from focused group discussions. Furthermore, scabies is frequently found in Segara Anakan Lagoon, which is often neglected by farmers while this disease caused low of livestock productivity. The knowledge scores of farmers were measured on the basis of their pre-test and post-test results during the extension programme. Forage preservation was composed of seven question items (Table 1), and scabies prevention contained three question items (Table 2). The score was collected from the right answers. The maximal value for each question was one.

Farmers' interviews were carried out to collect data. Knowledge score was used to determine farmers' knowledge index regarding sheep farming practices, such as the type of forages, hay-making material, hay-making process, characteristics of good hay, silage-making materials, silage-making steps and characteristics of good silage, and scabies prevention, such as the causes of scabies, symptoms of scabies and medication of scabies. Knowledge level was measured by using a knowledge test. For quantitative measurements, the concept of scaling method was mostly used. The level of knowledge of the respondents was determined on the basis of whether they possessed low, medium or high knowledge (De la Fuente et al. 2017).

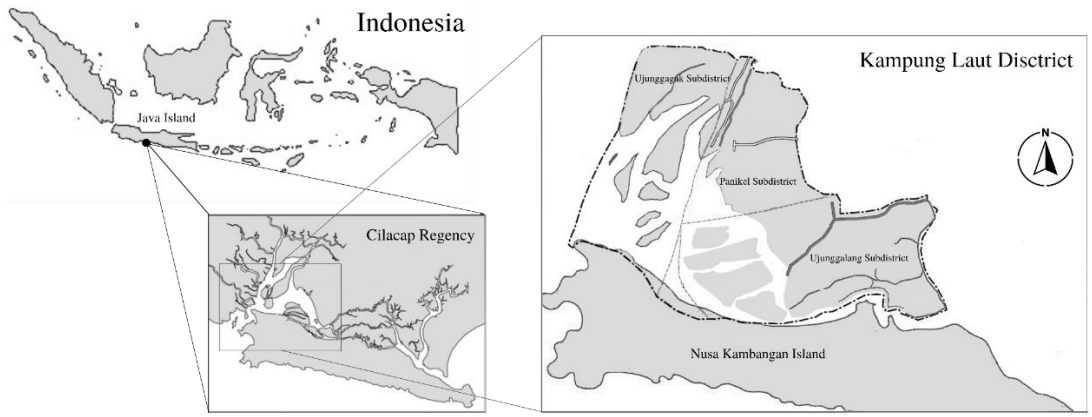

Figure 2. Location of Segara Anakan, Central Java, Indonesia

Table 1. Pre- and post-test questions on forage preservation

No	Subjects	Number of Correct Answers	Score for a Correct Answer	Maximum Score for A Question
1	Types of forage • Kangkung/*Ipomoea aquatica Forsk* • Kalanjana grass/*Pennisetum purpureum* • Cassava leaves/*Manihot esculenta* • Gamal/*Gliricidia sepium* • Calliandra/*Calliandra calothyrsus*	5	0.20	1
2	Hay-making materials • Grass • Legume	2	0.50	1
3	Hay-making process • Chopping • Drying • Storing	3	0.33	1
4	Characteristics of good hay • Retaining green colour with some yellowing • Having few damaged leaves • Preserving the whole and clear forms • Not being too dry to prevent breakage	4	0.25	1
5	Silage-making materials • Forage • Rice bran • Molasses • Broken rice grain • *Onggok** • Plastic bag	6	0.17	1
6	Silage-making steps • Chop forage into 5–10 cm pieces using a cutting tool • Mix the chopped forage with the remaining silage-making materials thoroughly • Place the mixture into the silo (plastic bag) and tightly pack it to avoid any air space • Fill up the silo all the way to the top • Cover the silo tightly with plastic, and place weight on top of the cover • The ensiling process takes place for 3 weeks. Silage can be immediately consumed by livestock. Ensiled feed can be stored for 1–2 years in airtight storage.	6	0.17	1
7	Characteristics of good silage • Giving out acidic taste and odour • Retaining green colouring • Retaining clear texture • No mould, mucous and congealment	4	0.25	1
Maximum Score				7

*a by-product of cassava processing to produce tapioca

Table 2. Pre- and post-test questions on scabies prevention

No	Subjects	Number of Correct Answers	Score for a Correct Answer	Maximum Score for Each Question
1	Causes of Scabies *Sarcoptes scabiei* infection Poor hygiene	2	0.50	1
2	Signs of Scabies Decreased appetite Increased scratching Scabs on skin Falling fur Skinny	5	0.20	1
3	Medication for Scabies Clean scabs Apply sulphur on scabs	2	0.50	1
Maximal Score				3

Data analysis

The data collected were tabulated and summarised by calculating means, percentages and standard deviations using Stata™ software, version 16. The level of knowledge of farmers on feed preservation was calculated by categorising their score on the knowledge test as low (0–2.5), medium (2.6–5.0) and high (5.1–7.0). Furthermore, the knowledge level of farmers on scabies prevention was categorised as low (0–1.0), medium (1.1–2.0) and high (2.1–3.0). Furthermore, the knowledge index was calculated by using the following formula:

$$\text{Knowledge index} = \frac{\text{Score of correct responses}}{Total\ score\ of\ knowledge\ item}\ x100$$

The results of improving knowledge on feed preservation and scabies prevention were compared by using statistical analysis methods, such as tabulation, mean, percentage, f test and t test. Multiple regression analysis was used to examine the influence of farmers' characteristics on improving knowledge using the following formula:

$$Y_1 = a + b_1X_1 + b_2X_2 + b_3X_3 + e$$

$$Y_2 = a + b_1X_1 + b_2X_2 + b_3X_3 + e$$

where Y_1 is knowledge improvement of farmers on forage preservation, Y_2 is knowledge improvement of farmers on scabies prevention, a is constant and $b_{1,2,3,4}$ is coefficient, X_1 is age (year), X_2 is level of education (year), X_3 is experience in sheep farming (year), X_4 is sheep holding (head), and e is error.

RESULTS AND DISCUSSION

Improving the knowledge of farmers on forage preservation and scabies prevention

Sufficient knowledge on feeding animals is an important requirement in sheep farming. Farmers should have sufficient knowledge regarding the type of forage, hay-making material, hay-making process, characteristics of good hay, silage-making material, silage-making step and characteristics of good silage. Table 3 shows that before the extension programme, the average score on forage preservation was 1.79. Their average score tripled to 5.16 after the programme. The average improvement score reached 3.36.

The highest improvement of knowledge was achieved by the question items on characteristics of good silage, hay-making process, silage-making materials and characteristics of good hay, in which the improvement score reached more than 0.50. Farmers initially had limited knowledge on the hay-making process, characteristics of good hay and characteristics of good silage, as shown by the low scores in the pre-test. However, after the extension programme, their scores reached 0.65 for the hay-making process, 0.56 for the characteristics of good hay and 0.67 for the characteristics of good silage. Four correct answers were recorded for the characteristics of good hay, namely, retaining a green colour with some yellowing, having a small number of damaged leaves, preserving the whole and clear forms and being not too dry to prevent breakage. The farmers were able to recognise one of the

four answers. The silage-making steps consisted of six correct answers, two of which were identified by the farmers after extension. The characteristics of good silage consisted of four correct answers, two of which were identified by the farmers.

The average pre-test score of knowledge on hay-making process was 0.06, but the score increased to 0.65 after the intervention. The farmers reported that the explanation on the hay-making process was easy to understand, and they wanted to practice it immediately because of the straightforward process. The farmers initially scored an average of 0.05 on the characteristics of good silage, but this score improved to an average of 0.67 after the extension programme (Table 3).

The farmers were not aware of *Gliricidia sepium* and *Calliandra calothyrsus* as the forage prior to the extension because these species were not available in the area. These farmers only knew of *Ipomoea aquatica* Forsk, *Manihot esculenta* and *Pennisetum purpureum*. The average score of the farmers on this information was 0.61, but this score improved to 0.86 on the post-tests. This result indicated that the farmers now knew that *Gliricidia sepium* and *Calliandra calothyrsus* could be used in forage for their sheep.

The sheep farmers experienced a significant change in knowledge as evidenced by the paired-sample f-test analyses on the differences between the scores of pre-tests and post-tests. Each of the seven question items resulted in significant differences at $P \leq 0.01$. These results demonstrated that the knowledge of the farmers on forage preservation significantly improved after they participated in the extension programme.

Based on the pre-test scores, hay and silage were feed technologies that were not recognised by the sheep farmers along the coastal area. Most of these farmers did not know the production process and characteristics of good silage. After the extension, the farmers received information on such subjects, and their knowledge was improved.

Scabies is a common disease of sheep in the study area. However, farmers lacked adequate knowledge on this disease. The result showed that the average score on the pre-test yielded 0.55, but it increased to 2.11 after the extension. The average improvement score after the extension reached 1.56 (Table 4). The knowledge of farmers was improved by the questions regarding the causes of scabies, symptoms of scabies and scabies medication. The mean scores were low in the beginning at 0.14, 0.26 and 0.15, but such scores improved to 0.67, 0.70 and 0.74, respectively, on the post-tests. Before the extension, the average score on scabies prevention was 0.55 and reached 2.11 after the extension (Table 4).

Table 3. Level of knowledge regarding forage preservation

	Maximal score	Pre-test	Post-test	t value	Improving score
Types of forages	1	0.61 (±0.14)	0.86 (±0.18)	24.96***	0.25
Hay-making materials	1	0.53(±0.28)	0.95 (±0.12)	24.10***	0.42
Silage-making materials	1	0.24 (±0.23)	0.81 (±0.29)	27.80***	0.57
Hay-making process	1	0.06 (±0.16)	0.65 (±0.21)	39.12***	0.59
Silage-making steps	1	0.25(±0.15)	0.67 (±0.19)	31.30***	0.42
Characteristics of good hay	1	0.05 (±0.13)	0.56 (±0.18)	42.79***	0.51
Characteristics of good silage	1	0.05 (±0.12)	0.67 (±0.21)	41.49***	0.62
Total	**7**	1.79 (±0.09)	5.17(±0.97)		3.38 (±0.88)
F-value					72.675***

*** Significant at 1% level

Table 4. Level of knowledge regarding scabies prevention

Parameter	Maximal score	Pre-test	Post-test	t value	Improving score
Causes of scabies	1	0.14 (±0.23)	0.67(±0.26)	25.76***	0.53
Symptoms of scabies	1	0.26 (±0.20)	0.70 (±0.15)	29.74***	0.44
Medication of scabies	1	0.15 (±0.24)	0.74 (±0.28)	25.73***	0.59
Total	3	0.55 (± 0.40)	2.11 (±0.41)		1.56 (±0.54)
F value					14.031***

***Significant at 1% level

The farmers were able to identify at least one of the two correct answers for the steps in scabies medication, namely, cleaning the infected parts and applying sulphur topically. The knowledge of the farmers on other subjects of scabies prevention was also significantly improved.

The farmers who previously worked in fisheries did not have basic experience and knowledge on sheep farming. Furthermore, they started with poor practices, such as minimal sanitation in the sheepfold, which made the sheep vulnerable to scabies. Fortunately, the extension programme helps the farmers improve their knowledge on scabies prevention. They were able to identify at least one of the causes of this disease, namely, *Sarcoptes scabiei* infection and poor sanitation of enclosures. They were also able to identify at least two of the symptoms of scabies, namely, low appetite, high scratching, many scabs, falling fur and emaciation.

Before intervention on forage preservation, most of the farmers pursued a low category of knowledge (91.70%), followed by medium level (8.30%). No farmers showed a high knowledge level. Similarly, related to the issue of scabies prevention, farmers mostly fell under the category of low level (83.40%) and medium level (16.60%). The number of farmers in the high knowledge level increased after scientific intervention (Tables 5 and Table 6). Young et al. (2015) and Danso-Abbeam et al. (2018) also reported that agricultural extension can be used to improve farmers' knowledge and practices.

Comparison of the improvement of knowledge on forage preservation and scabies prevention

T-test analyses indicated a significant difference in knowledge index on forage preservation and scabies prevention issues. Table 7 describes that extension could improve knowledge on both issues, but knowledge improvement on scabies prevention is higher than that on forage preservation. The high knowledge index of scabies prevention amongst the farmers was due to the fact that the farmers did not have any prior knowledge on scabies. Traditionally, farmers tended to ignore scabies because no death associated to scabies has been reported. Prior knowledge provides a boost to learning, and it is related to the subsequent learning process (Wade & Kidd 2019).

Many farmers in the study area only provide grass and legume to their livestock. However, the availability of grass and legume is limited during the dry season, resulting in poor nutrition of livestock (Sudarman et al. 2016). Hay and silage can solve forage scarcity during the dry season. Converting forage into hay and silage not only preserves forage but also increases the nutrient content. Hay is forage preservation in a dry form with a moisture content of 20% to 35%. Hay production aims to maintain the dry matter and nutrients during the storage of forage. Hay can be stored as feed for 1 year or longer. Silage is forage preservation in its fresh state under an anaerobic condition, which allows fermentation (Muck & Collins 2020; Rotz et al. 2020). Silage-making utilises

Table 5. Knowledge condition on sheep farming practices for forage preservation

Condition	Category of knowledge		
	Low (0-2.50)	Medium (2.60-5.00)	High (5.10 -7.00)
Pre-test	121 (91.70%)	20 (8.30%)	0
Post-test	11 (4.60%)	43 (17.80%)	187 (77.60%)

Table 6. Knowledge condition on sheep farming practices for scabies prevention

Condition	Category of knowledge		
	Low (0-1.00)	Medium (1.10-2.00)	High (2.10 -3.00)
Pre-test	201 (83.40%)	40 (16.60%)	0
Post-test	2 (0.80%)	85 (35.30%)	154 (63.90%)

Table 7. Difference in knowledge index between forage preservation and scabies prevention

Extension Issues	Knowledge Index
Forage Preservation	49.24
Scabies Prevention	53.26
t-statistic	3.02***

*** p-value with a significant level at 1%

additives, such as molasses, concentrate and minerals, to catalyse fermentation.

Figures 3 and 4 show the growth in knowledge of each extension issue in detail. The highest knowledge improvement in forage preservation was regarding the characteristics of good silage (0.62) and hay-making process (0.57). In scabies prevention, the highest knowledge improvement was regarding the medication for scabies (0.59) and symptoms of scabies (0.44, Figure 4).

A high knowledge index indicated that the extension material was well communicated, and farmers were able to understand the added information. The topics were selected after a discussion with the farmers prior to the extension, indicating that the farmers were aware of the problems they were facing and motivated to find solutions. Extension is a group study activity amongst farmers to increase their knowledge. An extension is effective when it can provide farmers with relevant recommendations that are easily and timely accessible to overcome their challenges. The recent technology must also be pertinent to the socioeconomic conditions of farmers (Ebenehi et al.2018; Mapiye et al. 2021).

The philosophy of extension '*helping farmers to help themselves'* (Ghimire & Suvedi 2017). is highly relevant to the results of this study. The extension aimed to help farmers improve their knowledge on forage preservation and scabies prevention. The resulting knowledge improvement can help farmers solve their problems on forage provision and scabies prevention of their livestock. The farmers are expected to apply the new-found knowledge to increase the productivity, profitability and sustainability of their livestock (Wheeler et al. 2017).

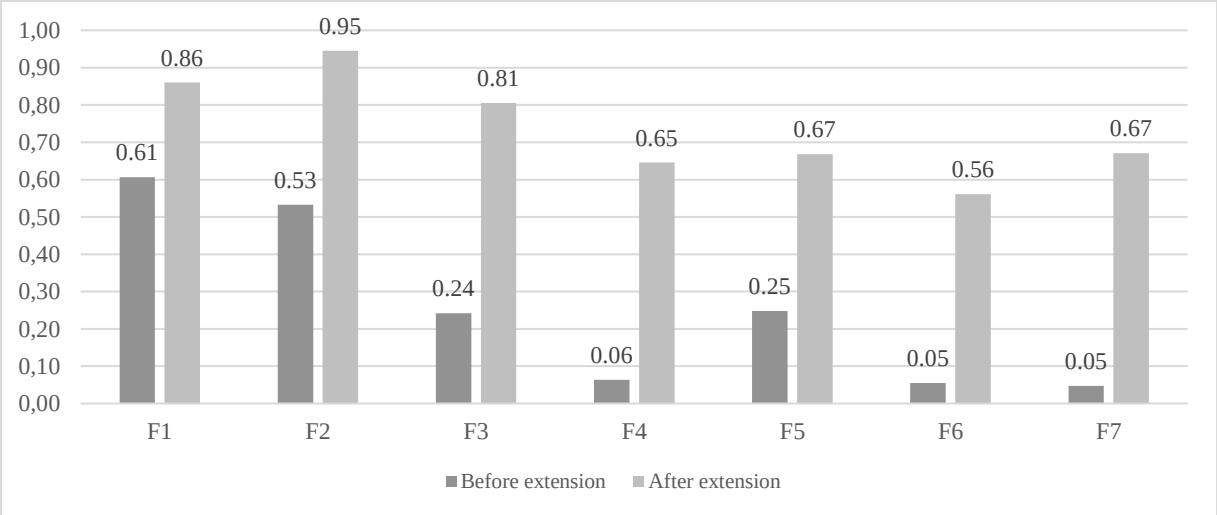

Figure 3. Level of knowledge on forage preservation before and after extension. F1= Types of forage; F2= Hay-making materials; F3= Hay-making process; F4= Characteristics of good hay; F5= Silage-making materials; F6= Silage-making steps; F7= Characteristics of good silage

Characteristic factor analysis on knowledge improvement of farmers

Farmers' education and experience in sheep farming significantly influences the knowledge improvement of farmers on forage preservation (P≤0.01 and P≤0.05). There was an increase in farmers' education and experience in sheep farming with an increase in knowledge improvement. This study found that farmers' age would influence the knowledge improvement of farmers on scabies prevention (P≤0.10). The result of characteristic factor regression analyses is described as follows:

1. $Y_1 = 12.96 + 3.04X_2 + 2.53X_3$
2. $Y_2 = 10.65 - 1.82X_1$

Productive farmers have some advantages of better working abilities, stronger stamina, and endurance, more open to new things, willing to try an innovation and share knowledge (Ibrahim et al. 2019). They also have a high probability of participation in agricultural extension activities (Suvedi et al. 2017). The result of this study showed that the knowledge improvement of the farmers on scabies prevention at a lower rate as they become older (Table 8).

Experience in sheep farming describes how long a farmer has been carrying out sheep farming in a matter of years. The knowledge improvement of farmers on forage preservation is higher with the longer of experience in sheep farming (P≤0.10). The longer the experience will enable the farmers to analyze innovations, which in turn increases the profits of their operations. Livestock experience plays a significant role in determining the success of farmers in improving the development of the farming business and the income of farmers. Previous studies also obtained results that farmers experience is found to be the potential factors of knowledge level (Duong et al. 2019; Šūmane et al. 2018).

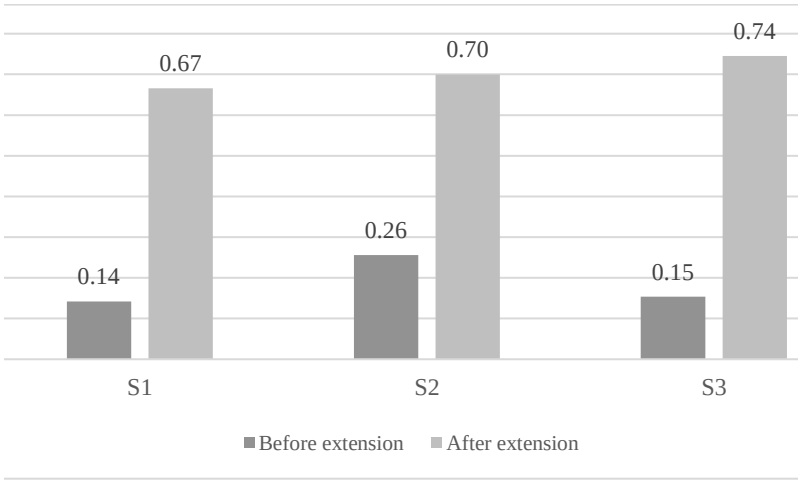

Figure 4. Level of knowledge on scabies prevention before and after extension**.** S1 = Causes of scabies; S2 = Signs of scabies; S3 = Medication of scabies

Table 8. Effects of characteristic factors on improving the knowledge of farmers

Variables	Forage Preservation		Scabies Prevention	
	Coefficients	p-value	Coefficients	p-value
Age	-0.62	0.53	-1.82	0.07*
Education	3.04	0.00***	1.16	0.24
Experience in sheep farming	2.53	0.01**	-0.53	0.59
Sheep holding	0.11	0.90	-1.07	0.28
	Constant = 12.96		Constant = 10.65	
	R Square = 0.06		R Square = 0.03	
	Std. Error = 0.69		Std. Error = 0.53	

*** *p*-value with a significant level at 1%; ** *p*-value with a significant level at 5%; **p*-value with a significant level at 10%

CONCLUSION

Farmers' knowledge on forage preservation and scabies prevention improved after participating in the extension program. The extension program proved to have a positive impact on the knowledge level of sheep farmers in Segara Anakan lagoon coastal area. The knowledge improvement were indicated through increasing the number of farmers with high level of knowledge after the extension intervention. Therefore, farmers should be provided many more opportunities to participate in the kinds of scientific intervention programs that can enhance their knowledge and skills.

Farmers' education and experience in sheep farming significantly influences the knowledge improvement of farmers on forage preservation. Farmers' age would influence the knowledge improvement of farmers on scabies prevention. It is critical to understand how farmers' knowledge levels differ, so that the extension may achieve the best possible knowledge improvement by tailoring the content and delivery methods of information on good or modern agricultural practices in a specific area.

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REFERENCES

De Jesus NM, Buenas LJE. 2023. Descriptive Analytics and Interactive Visualizations for Performance Monitoring of Extension Services Programs, Projects, and Activities. Int J Adv Comput Sci Appl. 14:660–668. DOI:10.14569/IJACSA.2023.0140173.

De la Fuente J, Cubero I, Sánchez-Amate MC, Peralta FJ, Garzón A, Fiz Pérez J. 2017. The adolescent's competency for interacting with alcohol as a determinant of intake: The role of self-regulation. Front Psychol. 8:1–14. DOI:.10.3389/fpsyg.2017.01800.

Duong TT, Brewer T, Luck J, Zander K. 2019. A global review of farmers' perceptions of agricultural risks and risk management strategies. Agric. 9. DOI:10.3389/fpsyg.2017.01800.

Ebenehi O, Ahmed TA, Barnabas TM. 2018. Evaluation of Extension Services Delivery for Climate Change Adaptation by Crop Farmers in Niger State, Nigeria. Asian J Agric Extension, Econ Sociol. 27:1–13. DOI:10.9734/ajaees/2018/39681.

Etwire PM, Buah S, Ouédraogo M, Zougmoré R, Partey ST, Martey E, Dayamba SD, Bayala J. 2017. An assessment of mobile phone-based dissemination of weather and market information in the Upper West Region of Ghana. Agric Food Secur. 6:1–9. DOI:10.1186/s40066-016-0088-y.

Gayatri S, Gasso-tortajada V, Vaarst M. 2016. Assessing sustainability of smallholder beef cattle farming in Indonesia: A case study using the FAO SAFA Framework. J Sustain Dev. 9:236. DOI:10.5539/jsd.v9n3p236.

Ghimire R, Suvedi M. 2017. A Qualitative Study Examining Core Competency Needs of Agricultural Extension Professionals in Nepal. Asian J Agric Extension, Econ Sociol. 18:1–12. DOI:10.9734/ajaees/2017/34517.

Hegde NG. 2019. Livestock development for sustainable livelihood of small farmers. Asian J Res Anim Vet Sci. 1:1–17.

Hosking SM, Dobbins AG, Pasco JA, Brennan SL. 2015. Knowledge change regarding osteoporosis prevention: Translating recommended guidelines into user-friendly messages within a community forum. BMC Res Notes. 8:4–8. DOI:10.1186/s13104-015-0985-3.

Hundal JS, Sodhi SS, Gupta A, Singh J, Chahal US. 2016. Awareness, knowledge, and risks of zoonotic diseases among livestock farmers in Punjab. Vet World. 9:186–191. DOI:10.14202/vetworld.2016.186-191.

Ibrahim A, Artama WT, Widayanti R, Yulianto MDE, Faqar D, Budisatria IGS. 2019. Sheep traders preferences on marketing place and their satisfaction during Eid al-Adha period in Yogyakarta, Indonesia. IOP Conf Ser Earth Environ Sci. 372. DOI:10.1051/bioconf/20213304010.

Ihsan YN, Asdak C, Dhahiyat Y, A Kamarudin MK, Gasim MB, Ireana Yusra AF, Juahir H. 2018. Impact sedimentation to community structure macrozoobenthos in Segara Anakan Lagoon. J Fundam Appl Sci. 10:565–579.

Jost C, Kyazze F, Naab J, Neelormi S, Kinyangi J, Zougmore R, Aggarwal P, Bhatta G, Chaudhury M, Tapio-Bistrom ML, et al. 2016. Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Clim Dev. 8:133–144. DOI:10.1080/17565529.2015.1050978.

Mapiye O, Makombe G, Molotsi A, Dzama K, Mapiye C. 2021. Towards a revolutionized agricultural extension system for the sustainability of smallholder livestock production in developing countries: The potential role of icts. Sustain. 13. DOI:10.3390/su13115868.

Masephula L, Olorunfemi OD. 2023. Correlates of smallholder poultry farmers extension and marketing information needs: Evidence from north-eastern South Africa. Inf Dev. 40. DOI:10.1177/02666669221148694.

Muck RE, K. L, Collins M. 2020. Silage Production. In: Moore KJ, Collins M, Nelson CJ, Redfearn DD, editors. Forages Sci Grassl Agric. 7th ed. United Kingdom (UK): Wiley-Blackwell; p. 767–787.

Qui NH, Thu NTA, Linh NT. 2024. The awareness and behaviour's farmer towards highly pathogenic avian influenza prevention in Tra Vinh, Vietnam. J Indones Trop Anim Agric. 164:169–180. DOI:10.14710/jitaa.49.2..

Robertson ID. 2020. Disease Control, Prevention and On-Farm Biosecurity: The Role of Veterinary Epidemiology. Engineering. 6:20–25. DOI:10.1016/j.eng.2019.10.004.

Rokhani R, Fauziyah D, Supriono A, Hariyati Y, Raharto S, Hapsari TD, Adi AH, Khasan AF, Rondhi M. 2021. Factors affecting the participation of sugarcane and tobacco farmers in farmer groups, associations and cooperatives in Indonesia. Caraka Tani J Sustain Agric. 36:340. DOI:10.20961/carakatani.v36i2.46817.

Rose D, Zainuri M, Anggoro S, Winanto T. 2016. Analisis perubahan tata guna lahan kawasan segara anakan selama periode waktu (1978-2016) menggunakan satelit landsat multitemporal. Omni-Akuatika. 12:144–150.

Rotz CA, Shinners KJ, Digman M. 2020. Hay harvest and storage. In: Moore KJ, Collins M, Nelson CJ, Redfearn DD, editors. Forages Sci Grassl Agric. 7th ed. United Kingdom (UK): Wiley-Blackwell; p. 749–766.

Sanjatmiko P. 2021. Multispecies ethnography: reciprocal interaction between residents and the environment in Segara Anakan, Indonesia. South East Asia Res. 29:384–400. DOI:10.1080/0967828X.2021.1978313.

Sari LK, Adrianto L, Soewardi K, Atmadipoera AS, Hilmi E. 2016. Sedimentation in lagoon waters (Case study on Segara Anakan Lagoon). AIP Conf Proc. 1730. DOI: 10.1063/1.4947417.

Skaalsveen K, Ingram J, Urquhart J. 2020. The role of farmers' social networks in the implementation of no-till farming practices. Agric Syst. 181:102824. DOI:10.1016/j.agsy.2020.102824.

Sudarman A, Hayashida M, Puspitaning IR, Jayanegara A, Shiwachi H. 2016. The use of cassava leaf silage as a substitute for concentrate feed in sheep. Trop Anim Health Prod. 48:1509–1512. DOI:10.1007/s11250-016-1107-5.

Sulastri E, A'Yun AQ, Widi TSM. 2020. Women's role in raising sheep activities through sharing system at Kampung Laut, Cilacap. IOP Conf Ser Earth Environ Sci. 454. DOI:10.1088/1755-1315/454/1/012067.

Šūmane S, Kunda I, Knickel K, Strauss A, Tisenkopfs T, Rios I des I, Rivera M, Chebach T, Ashkenazy A. 2018. Local and farmers' knowledge matters! How integrating informal and formal knowledge enhances sustainable and resilient agriculture. J Rural Stud. 59:232–241. DOI:10.1016/j.jrurstud.2017.01.020.

Suvedi M, Ghimire R, Kaplowitz M. 2017. Farmers' participation in extension programs and technology adoption in rural Nepal: a logistic regression analysis. J

Agric Educ Ext. 23:351–371. DOI:10.1080/1389224X.2017.1323653.

Triveni G, Sharma GRK, Satyanarayana C, Rao KS, Raghunandhan T. 2018. Knowledge Level of Dairy Farmers on Adoption of Dairy Innovations in Andhra Pradesh-An Analysis. Indian Res J Ext Edu. 18. DOI:10.1016/j.jenvman.2020.111654.

Udo HMJ, Budisatria IGS. 2011. Fat-tailed sheep in Indonesia; an essential resource for smallholders. Trop Anim Health Prod. 43:1411–1418.

Umeh OJ, Igwe KC, Anyim A. 2018. Farmers Knowledge of the Role of Extension Services in Akwa-Ibom State Nigeria. J Agric Ext. 22:87–96.

Wade S, Kidd C. 2019. The role of prior knowledge and curiosity in learning. Psychon Bull Rev. 26:1377–1387. DOI:10.3758/s13423-019-01598-6.

Wheeler SA, Zuo A, Bjornlund H, Mdemu MV, Rooyen A Van, Munguambe P, Ann S, Zuo A, Bjornlund H, Mdemu MV. 2017. An overview of extension use in irrigated agriculture and case studies in south-eastern Africa. Int J Water Resour Dev. 33:755–769. DOI:10.1080/07900627.2016.1225570.

Xu M, Zhang Z. 2021. Farmers' knowledge, attitude, and practice of rural industrial land changes and their influencing factors: Evidences from the Beijing-Tianjin-Hebei region, China. J Rural Stud. 86:440–451. DOI:10.1016/j.jrurstud.2021.07.005.