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Training on Tunnel Technology to Increase Salt Production in Jepara Regency

Dias Prihatmoko[1], Arif Mustofa[2]*, Sarwido[3], Akhmad Pandhu Wijaya[4]

[1,2,3)] Universitas Islam Nahdlatul Ulama Jepara, Indonesia
[4)] Universitas Wahid Hasyim, Indonesia
* Correspondence e-mail; arifmustofa@unisnu.ac.id

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Abstract

Rainfall is one of the factors that can affect salt production in Jepara Regency. Rainwater, when mixed with old water, causes evaporation to fail. Salt tunnel technology can retain rainwater so that salt farmers can still produce salt even during the rainy season. However, salt farmers have not fully utilized this technology. For this reason, assistance is needed to apply salt tunnel technology. This community service is conducted to increase the knowledge and skills of salt farmers about salt tunnel technology. The service partner is UKM Rumah Garam in Surodadi Village, Kedung District, Jepara Regency. Activities were carried out in August 2024. The flow of implementing activities is preparation, provision of tools and materials, implementation of training, partner assistance, and evaluation. Fifteen partner members attended the training. The mentoring method was carried out by providing classical training and practice in making salt tunnel construction. The results showed increased partners' knowledge about salt tunnel technology and skills in salt tunnel construction. Data on salt production using tunnels showed an increase of 42.85%. Measurement of partner perceptions through questionnaires showed an increase in knowledge and skills by 20.00%.

Keywords Garam; Jepara; Pelatihan; Tunnel

1. INTRODUCTION

The establishment of salt commodity as one of the potential products of Jepara Regency is proven by the existence of salt-producing centers that drive the community's economy in Kedung Sub-district and are spread across Tanggultlare, Bulak Baru, Panggung, Surodadi, Kalianyar, and Kedungmalang Villages. The area of salt ponds is 552.15 hectares, and the number of salt farmers is 573 people. (Febrizki & Luthfi, 2022). In 2023, salt production in Jepara Regency was 56,564.03 tonnes. (Diskan Kab Jepara, 2024). These conditions are very feasible for the development of a salt business, which is one of the superior products in Jepara Regency (Mustofa, 2016). One of the area where the community has a salt farming profession is Surodadi Village.

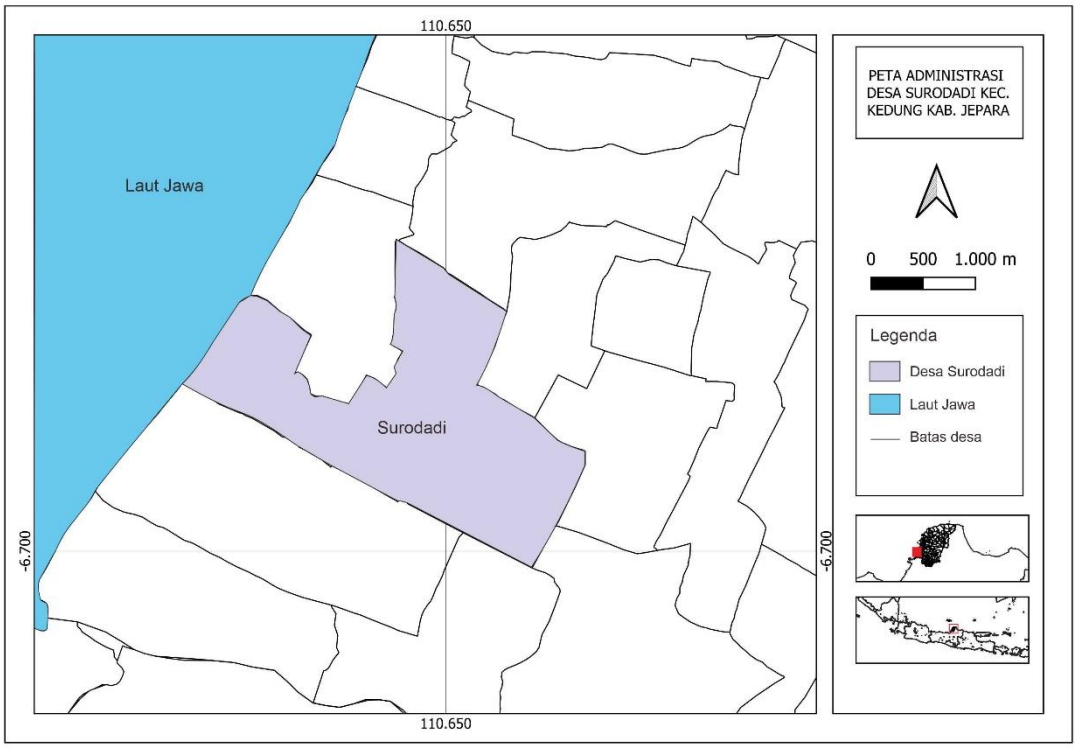


Figure 1. Administrative map of Surodadi Village, Kedung Sub-district Jepara Regency

One of the small and medium enterprises engaged in the salt sector is the Jepara Salt House SME with the address Surodadi Village RT 19 RW 6 Kedung District Jepara Regency. UKM Rumah Garam Jepara is led by Mr Ahmad Falaq, founded in 2018. This group has a total land area of 4.5 Ha with a total salt production of 400 tonnes in 2023. In addition to salt production, this group also conducts activities as a distributor of kiosk salt, which is sold to several buyers.

Figure 2. UKM Rumah Garam Jepara, as a distributor of kiosk salt, carries out salt delivery activities for several buyers

Salt farmers generally produce salt traditionally so that the salt yield is in the form of kiosk (Prihatmoko et al., 2024). They produce during the dry season only, while during the rainy season, they cannot produce salt (Mahasin et al., 2020). Salt farmers rely more on direct sunlight for the evaporation of seawater in the salt fields (Bawahab et al., 2019); (Rghif et al., 2019); (Parsa et al., 2021). The average production period is only 6 - 7 months; the rest is the rainy season (Adiraga & Setiawan, 2014). Rainfall is one of the factors that affect people's salt production (Prabawa & Bramawanto, 2021); (Petereit et al., 2018); (Liu et al., 2022); (Bhat et al., 2015). Thus, many salt farmers in Jepara Regency cannot produce salt because seawater mixed with rainwater cannot be used as raw material for making salt. This condition will also have an impact on the income and economy of salt farmers (Saiful et al., 2019). Therefore, there is a need for assistance from experts or experts who can help find solutions for salt farmers, especially in production technology, so that they can produce salt throughout the year in a sustainable manner without depending on the season (Joesidawati & Suwarsih, 2019); (Amin, 2023).

The technology used by salt farmers in Jepara District has all used isolators. This technology covers the bleaching grounds and evaporation plots with 250 μm thick LDPE plastic. The function of this plastic is to retain water so that it does not seep into the subsoil, store solar radiation heat to accelerate evaporation, and produce

clean salt because, at harvest time, the salt is not mixed with the subsoil (Tansuchat, 2023); (Prajapati et al., 2021); (Chakrabarty et al., 2020).

The next technological development is to strive for continuous salt production. This concept gave birth to how to produce salt during the rainy season. So the idea emerged to make a glass house to protect the salt plots from rainwater (Prabawa & Bramawanto, 2021); (Nuzula et al., 2023). The salt tunnel technology is based on the concept of glasshouse production. The construction uses a bamboo frame, making it easy and inexpensive for salt farmers. The land is still covered with isolators, and the roof uses white UV plastic with a thickness of 300 μm. There are several types of tunnel shapes, namely dome, pyramid, and treason shapes with an elongated shape that covers the land below (Guntur et al., 2018). Many coating and protective materials use plastic because it is cheap, inexpensive, and efficient in use in salt ponds (Dwiyitno et al., 2021).

Salt tunnel technology needs to be communicated to salt farmers in Jepara Regency. Many salt farmers are already using this technology (Saiful et al., 2019); (Amin, 2023); (Joesidawati & Suwarsih, 2019). However, not many salt farmers in Jepara Regency still use this tunnel technology. This training aims to improve salt tunnel technology knowledge and skills for salt farmers in Jepara Regency. Hopefully, this training will enable salt farmers to apply salt tunnel technology to increase salt production.

Figure 3. Partner's Salt Pond Land

2. METHODS

Community service activities were carried out in August 2024 in Surodadi Village, Kedung District, Jepara Regency. This community service activity involves Jepara Salt House SME partners with 15 members. The method implemented is

training covering two stages with the targets of each activity, as shown in the following table.

Table 1. Activity stage and target achievement

No.	Activity stage	Activity Target
1.	Training	Increased knowledge of participants on salt tunnel technology
2.	Practical work	Improved skills of participants to construct salt tunnel technology

The flow of implementation of community service activities is preparation, provision of tools and materials, implementation of training, partner assistance, and evaluation (Mustofa & Wijanarko, 2022).

Figure 4. The flow of salt tunnel technology training activities

3. FINDINGS AND DISCUSSION

The salt production of salt farmers in Surodadi Village, Jepara Regency, in 2023 experienced a significant increase compared to the previous year, from 2,886.05 tonnes to 14,454.24 tonnes (Diskan Kab Jepara, 2024). This is due to a decrease in average annual rainfall from 7,550 mm/year to 5,490 mm/year (BMKG, 2024). This increase in salt production will be even greater if the rainfall factor is minimized. One technology that blocks rainwater from entering the salt field is salt tunnel technology.

Salt tunnel technology can increase annual salt output (Saiful et al., 2019), as salt production can run all year round and is not affected by rainfall (Joesidawati & Suwarsih, 2019). The tunnel technology applied to the Jepara Salt House SME is a tunnel with a bamboo frame, where the base uses HDPE (High et al.) plastic (Ramly et al., 2022)Cover all the ground up to the embankment and clamp it with clamps (Hoiriyah, 2019), while the top is covered with UV plastic (Pramudia et al., 2023).

Production data from Mr. Ahmad Falaq (Chairman of UKM Rumah Garam Jepara) shows that salt farmers can produce salt on a crystallization table measuring 8 x 22 m of 1.4 tonnes/day in the dry season, which lasts an average of 5 months and in the rainy season there is no salt production activity at all. So, the total average salt production is 1.4 tonnes x 5 months x 30 days = 210 tonnes. Meanwhile, if the tunnel is used, the daily production is only predicted to be half in the rainy season. So the total production becomes 0.7 tonnes x 7 months x 30 days = 147 tonnes, an increase in production of 63 tonnes or an increase of 42.85%.

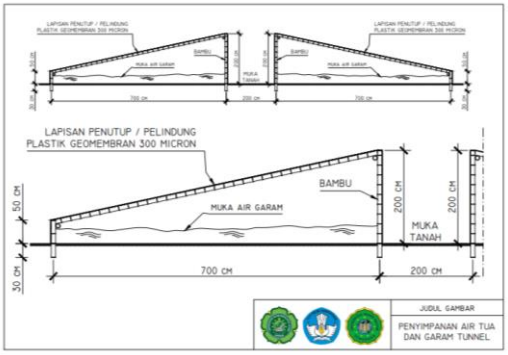
In order to increase the salt production of UKM Rumah Garam Jepara partners, it is necessary to assist with the stages as in Figure 4. The stages of this assistance are a way to achieve community service goals, namely increasing knowledge and skills in salt tunnel technology. The stages are as in the following sub-chapters.

3.1. Preparation

The initial stage of activity implementation is preparation by conducting a situation analysis—tools and materials to be prepared and measured with certainty and in consultation with the landowner. The service team and partners held discussions at the location where the salt tunnel technology will be built. The calculation of materials includes plastic isolator, UV plastic, bamboo, and wood, as well as the number of workers. The team has also made the tunnel construction design that the partners agreed upon. The construction partners need an old water tendon of 4 x 25 m, as much as 1 unit, and a crystallization table of 8 x 22 m, as much as two units. On that occasion, the budget requirements for the salt tunnel construction were also calculated together.

(a)  (b) 

Figure 5. Measurement of the land where the salt tunnel will be built, (a) measurement of the length and width of the crystallization table, (b) measurement of the length and width of the old water tendon.

(a) 

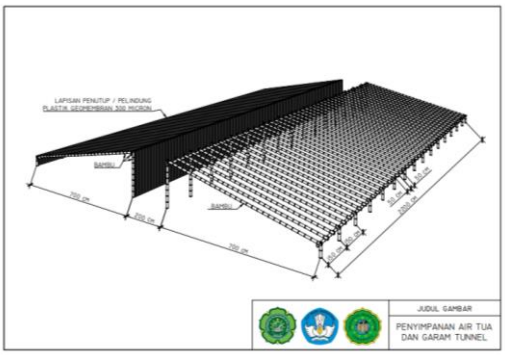
(b) 

Figure 6. Salt tunnel designs agreed upon by partners, (a) side view design of crystallization table tunnel and old water tendon tunnel, (b) 3-dimensional design of crystallization table tunnel.

3.2. Provision of Tools and Materials

Based on the offer agreed upon between the service team and partners, the next stage is to provide the necessary tools and materials. The tools needed to make the salt tunnel are as follows.

Table 2. Tools and materials for making salt tunnels

No.	Tools and Materials	Vol	Unit
Old water reservoir 4 x 25 m			
1.	Bamboo 12 m	20	Trunk

2.	Bamboo 6 m	100	Trunk
3.	Geoisolator L.6m	0,5	Rolls
4.	Plastic UV 300µm	0,5	Rolls
4.	Sengon laut wood 3/5 p.4 m	40	Trunk
5.	Nails	3	Kg
6.	Rope	5	Kg
Crystallization table 8 x 22m (per 1 unit)			
1.	Bamboo 12 m	10	Trunk
2.	Bamboo 6 m	75	Trunk
3.	Geoisolator L.4m	0,5	Rolls
4.	Plastic UV 300µm	0,5	Rolls
4.	Sengon laut wood 3/5 p.4 m	30	Trunk
5.	Nails	3	Kg
6.	Rope	5	Kg

3.3. Training

Salt production technology training was conducted in Surodadi Village, Kedung Subdistrict, Jepara Regency, on August 13, 2024. The target of the training activities was to increase the knowledge of the training participants about salt production technology. The training was attended by 15 participants from Surodadi Village Salt House group members.

(a)  (b) 

Figure 7. Training on sustainable salt production technology, (a) training participants listen to explanations from resource persons, (b) resource persons provide training materials on Sustainable Salt Production Technology.

Mr. Arif Mustofa, S.T., M.Si., with the title Sustainable Salt Production Technology, delivered the training on sustainable salt production technology. During

this training, salt farmers in Jepara Regency presented several salt-producing technologies. They also explained salt tunnel technology and how to make it.

3.4. Partner Assistance

After the training, the next activity was the construction of the salt tunnel. The salt tunnel is located on the land owned by Mr. Hambali, a salt farmer from Surodadi Village, Kedung Sub-district, Jepara Regency. Assistance was provided by a briefing on the process of making salt tunnels. The service team monitors the work so the tunnel construction is by the agreement and can be used for salt production.

(a) (b) (c)

Figure 8. The process of making salt tunnels, (a) the beginning of the salt tunnel making work in the new land, (b) the salt tunnel has been filled with old water, (c) the salt formed through the salt tunnel process

3.5. Evaluation

The evaluation was carried out to know the development of knowledge and insight into salt production technology. In addition, it is also to determine the value of the benefits received by participants from the training activities carried out. The evaluation was conducted through a questionnaire submitted to participants through an electronic form. The answers from the participants were dichotomous in facilitating evaluation measurement, namely between knowing and not knowing, being able and not being able, understanding and not understanding, and so on. They filled out the questionnaire using their respective smartphones, and the data collected was in tabular form and analyzed qualitatively by the service team (Nurdiani et al., 2020).

Table 3. Evaluation results of salt production technology training participants

No.	Question	Before training	After training	Increase/ Decrease

1.	Do you use salt production technology?	100%	100%	0%
2.	Do you know some salt production technologies?	100%	100%	0%
3.	Are you familiar with salt tunnel technology?	86,67%	100,00%	13,33%
4.	Do you know the advantages and disadvantages of salt tunnels?	66,67%	80,00%	13,33%
5.	Do you know the difference in salt production when using a salt tunnel?	53,33%	93,33%	40,00%
6.	Do you know the difference in salt quality when using a salt tunnel?	73,33%	93,33%	20,00%
7.	Do you know how to make salt tunnel technology?	66,67%	93,33%	26,67%
8.	Do you know why tunnel construction uses bamboo?	73,33%	86,67%	13,33%
9.	Do you know the function of using UV plastic for the tunnel roof?	60,00%	86,67%	26,67%
10.	Can you calculate the funding requirement for the salt tunnel?	46,67%	93,33%	46,67%

The table above shows that the participants have used and know the salt production technologies. This is shown in the first and second questions about the use and knowledge of several salt production technologies, which all participants answered. From the table above, it can also be seen that participants have increased their knowledge of salt tunnel technology. This is shown by the increase in participants who know and understand salt production technology. The highest increase was in the answer to the calculation of funding needs for the manufacture of salt tunnels, which amounted to 46.67%. At the same time, the lowest increase was in the questions on understanding salt tunnel technology, the advantages and disadvantages of salt tunnels, and the reason for tunnel construction using bamboo, where the overall increase was 13.33%. From all question points, when averaged, the value obtained before the training was 72.67% and increased to 92.67% after the training. This shows that the participant's knowledge and skills in salt tunnel technology in Jepara Regency increased by 20.00%.

4. CONCLUSION

The community service program activities increased participants' knowledge and skills about tunnel technology to increase salt production. At the end of the community service programme, the knowledge and skills of the partners increased

by 20.00%. While in salt production activities using salt tunnels, an increase in production was obtained by 42.85%

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