

Urgency Role of Agricultural Extension Workers to Improve the Implementation of Good Agricultural Practices Geographical Indications (GAP-GI) for Pepper Farmers

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Abstract

Implementing Good Agricultural Practices-Geographical Indications (GAP-GI) pepper is an effort to increase the production and productivity of pepper produced by farmers. For GAP-GI pepper to be optimally applied by farmers, the role of agricultural extension workers is needed. Extension workers bridge the gap between farmers' knowledge and GAP-GI practices. This study explores *how the application of pepper GAP-IG and the role of agricultural extension workers in the application of pepper GAP by farmers*. This study used a quantitative approach with survey methods, using a sample of pepper farmers in Bangka Belitung province, Indonesia, with as many as 270 people, sampling using *a multistage random sampling method*—data collection using observation, interview, and questionnaire techniques. Data were analyzed using descriptive statistics, tabulations, and Likert scales. The results showed that pepper farmers in implementing Good Agricultural Practices-Geographical Indications (GAP-IG) had not been maximized, with an achievement rate of 52.07 per cent. Meanwhile, the role of agricultural extension workers in implementing Good Agricultural Practices Geographical indications (GAP-GI) of pepper is also not optimal, with an achievement rate of 40.13 per cent. Improving the application of Good Agricultural Practices Geographical Indications (GAP-GI) pepper can be done by increasing the knowledge and skills of farmers in the selection and processing stages as well as the stages of integrated cultivation management. The government organizes special education and training for extension workers to improve competence and perform optimally.

Keywords: Role Extension, Good Agricultural Practices, Geographical Indications, Pepper Farmer, Muntok White Pepper

Introduction

Indonesia is known as the world's spice-producing country, also called the "Mother of Spices" (see also Sarma et al., 2014). The best Indonesian spice products worldwide are famous as "Lampung Black Pepper and Muntok White Pepper." Before World War II, Indonesia could meet the world's pepper needs by 80 per cent. Therefore, Indonesian pepper became an essential commodity in world trade (Nanda et al., 2020). The prominent pepper-producing countries globally listed as members of the international pepper community are India, Indonesia, Brazil, Malaysia, Vietnam, and Sri Lanka (Semuroh & Sumin, 2021). Pepper is a group of spice plants and the King of Spices or "*King of Spices*" with the Latin "*Piper nigrum*." The most widely used spice worldwide is Black Pepper or King of Spices (Sarma et al., 2014). It is used as a spice in cooking; pepper plants are used as antioxidants, antimicrobial, carminative, and antiseptic (Bagheri et al., 2014). Worldwide pepper consumption has increased yearly, especially the demand for pepper-based culinary products, forcing producers and farmers to grow more pepper to meet global demand (Semuroh & Sumin, 2021). Indonesian pepper is known in world trade under the names *Lampung Black Pepper* and *Muntok White Pepper*. As a pepper-exporting country, Indonesia has advantages and competitiveness in the international market (Azahari et al., 2021). Indonesia has the largest pepper production centre in the Bangka Belitung island province (Purwasih et al., 2020). White pepper produced from this province has *Geographical indications* (GI) with distinctive aroma and taste characteristics known as "Muntok White Pepper" (Darwance et al., 2023)

Currently, the condition of white pepper has decreased production and low productivity. In the last five years, Bangka Belitung's white pepper production has shown fluctuating and declining trends (Irawan, 2021). In addition, the low quality of crops is a significant problem that must be corrected in managing smallholder plantations (Sitorus et al., 2020). Farmers still apply traditional cultivation and low farmers' tendency to use technology and processing in the on-farm agribusiness subsystem. Therefore, implementing good agricultural practices (GAP) is very important to increase the productivity of white pepper plants (Astuti et al., 2019). (Astuti et al., 2019) GAP (Good Agricultural Practices) is a practice, efficient, on-farm and off-farm process aimed at sustainable production like smallholders with a codification system (Oo & Usami, 2020; Pongvinyoo et al., 2014). However, farmers' lack of knowledge and skills is the cause of low farmers implementing Good Agricultural Practices (GAP). According to Istriningsih et al (2022), Implementing GAP aims to increase farmers' knowledge about pesticides to reduce pesticide hazards and increase GAP adoption in farmers. Research on Thai vegetable farmers found that income and location influence GAP adoption (Laosutsan et al., 2019). So, there is no guarantee of increased production by increasing planting area if it does not follow good agricultural practices by farmers (Adhikari & Thapa, 2023). Limited access to extension services and agricultural consulting support exacerbates GAP implementation.

Addressing the low implementation of GAP, providing farmers with access to training, information, and improved extension services is essential. So, it can help bridge the gap between farmer knowledge and GAP practices, leading to increased productivity and sustainability of pepper crops. Agricultural extension workers are crucial in supporting farmers and addressing their challenges. An extension is a non-formal education process to improve knowledge, attitudes, skills, and behaviour so that the desired changes occur (Jelili et al., 2019). The role of extension workers is efficacious in improving crop quality and increasing productivity (Mohamed et al., 2021). Agricultural extension activities provide knowledge and skills to farmer groups (Jamil et al., 2021). In addition, extension workers are

a source of information for farmers and play an essential role in supporting sustainable agriculture (Alotaibi et al., 2021) and food security (Olorunfemi et al., 2020). Extension workers play multiple roles in the agricultural sector, including educators, facilitators, and motivators. This research is an effort to improve the function of extension workers consisting of roles as facilitators, motivators, educators, consultants, and communicators. Extension workers work to implement provincial or district government programs and can be facilitators, mediators, and community organizers among farmers and others (Tanjung et al., 2018). Based on the study of Jamil et al (2021), extension workers were better the more dynamic the farmer groups.

This study explores: 1) the application of Good Agricultural Practices-Geographical Indications (GAP-GI) pepper and 2) the role of agricultural extension workers in farmers' implementation of pepper GAP-IG. The results of this study are significant for agrarian development planning in improving the performance of pepper farmers and the role of extension workers to increase production, productivity, and sustainability of pepper commodities "*Muntok White Pepper*."

Research Method

This research has been conducted in Bangka Belitung Province, Indonesia, located at 104°50' to 109°30' East Longitude and 0°50' to 4°10' South Latitude. This study used a quantitative approach with survey methods. The population in this study is all farmers who cultivate white pepper in Bangka Belitung Province. Determination of research samples using a *multistage random sampling method*, with a total sample of 270 farmers. Data is obtained through collection in the field with observation techniques, interviews, and questionnaires that have been prepared. Data were analyzed using descriptive statistics, tabulations, and the Likert Scale (Affandi et al., 2022). Indicators of research variables can be seen in Table 1.

Table 1

Research Variable Indicators

Variable	Definition
Role of Extension	
Facilitator	provide facilities or assistance to serve the needs of farmers
Motivator	encourage and move farmers to be willing and able to implement pepper GAP-GI
Educator	provide knowledge skills and facilitate the learning process carried out by farmers
Consultant	help identify problems, solve problems, or provide solutions
Communicator	liaison between farmers and stakeholders or related parties related to white pepper
Mediator	convey information, messages, and credibility of messages to pepper farmers
GAP-GI	
Land Selection and Processing	Stages before pepper cultivation include topography, soil structure, and water availability.
Plant Cultivation Management	stages in the process of pepper cultivation, consisting of plant material, seeding, jarring, planting seedlings, maintenance, and fertilizing
Harvesting and Postharvest	stage of producing pepper plants consists of harvest time, stripping pepper seeds, and packaging

Determination of the level of achievement category of research variables is intended so that quantitative data from each research variable can be described more clearly and meaningfully. The criteria for the achievement level category of each variable can be seen in Table 2.

Table 1
Achievement Level Variables and Categories

No	Variable	Variables Achievement Level Category				
		0 - 20	> 20 - 40	>40-60	>60-80	>80-100
1	Facilitator	Never	Infrequently	sometimes	Often	Very Often
2	Motivator	Never	Infrequently	sometimes	Often	Very Often
3	Educator	Never	Infrequently	sometimes	Often	Very Often
4	Consultant	Never	Infrequently	sometimes	Often	Very Often
5	Communicator	Never	Infrequently	sometimes	Often	Very Often
6	Mediator	Never	Infrequently	sometimes	Often	Very Often
7	Land Selection and Processing	Never	Infrequently	sometimes	Often	Very Often
8	Plant Cultivation Management	Never	Infrequently	sometimes	Often	Very Often
9	Harvesting and Postharvest	Never	Infrequently	sometimes	Often	Very Often

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**VO**)

Meanwhile, to calculate the level of achievement of respondents (TCR) using the following formula:

$$TCR = \frac{\text{Mean}}{\text{Score Max}} \times 100$$

Results and Discussion

1. Good Agricultural Practices Geographical indications (GAP-GI):

Based on the results of field data, GAP-GI Pepper by farmers at the stage of selecting and processing land can be seen in Table 3

Table 3

GAP-GI: Land Selection and Processing

No	GAP-GI indicator	Score		TCR (%)	Category
		Interval	Average		
1	selection of pepper land by taking into account the height of the place less than 1000 M above sea level	0 - 2	0,96	48,15	S
2	selection of pepper land by paying attention to the slope of the land less than 10 degrees	0 - 3	1,50	50,00	S
3	selection of pepper land free from rubber or brown plants	0 - 3	1,31	43,70	S
4	land selection according to soil pH 5.5-6.5	0 - 3	0,86	28,52	I
5	land selection according to the type of lactose, podzolic soil	0 - 3	1,45	48,40	S
6	selection of land that the location of the land is free from chemical contamination	0 - 3	1,51	50,25	S
7	addition of organic matter	0 - 3	1,67	55,56	S
8	planting cover crops or Legumes cover crops (LCC)	0 - 3	0,68	22,72	I
9	digging wells or reservoirs as a source of water in the garden	0 - 3	1,42	47,28	S
10	creation of irritating channels in case of dry season	0 - 2	0,92	46,11	S
11	making drainage in anticipation of the rainy season	0 - 3	1,81	60,49	O
12	mechanical manufacture of drainage	0 - 3	0,54	18,15	N
13	creation of perimeter or partial drainage of garden sites	0 - 3	1,83	60,99	O
14	planting perimeter fences in pepper gardens	0 - 3	0,89	29,75	I
15	sterilization of the field before pepper is planted	0 - 3	1,25	41,60	S
	Total Score	0 - 43	18,61		
	Score Achievement			43,44	S

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**VO**)

Table 3 shows the land selection and processing stage in applying Good Agricultural Practices-Geographical Indications (GAP-GI) pepper with a variable achievement rate of 43.44 percent with occasional categories. Furthermore, good agricultural practices and geographical indications (GAP-GI) at the management stage of pepper cultivation can be seen in Table 4.

Table 4

GAP-GI: Plant Cultivation Management

No	Indicator GAP-GI	Score		TCR (%)	Category
		Interval	Average		
1	Preparation of seedling media	3	1,34	44,69	S
2	seedling medium using a mixture of soil, sand, and organic matter	3	1,27	42,35	S
3	The source of seedlings comes from the garden itself or others	4	3,11	77,87	O
4	seedlings from 7 internodes or one internode	4	2,49	62,13	O
5	planting distance 2.5 x 2.5 or 3 x 3	3	1,12	37,28	S
6	planting hole with a size of 45x45x45 cm (Deep LxLx)	3	1,48	49,38	S
7	Using live tajar (junjung)	3	1,10	36,54	I
8	Planting seedlings immersed in 2-3 internodes	4	1,85	46,30	S
9	shading for newly planted plants	4	2,95	73,80	O
10	Carrying out fastening of climbing tendrils	3	2,01	66,91	O
11	Carrying out pruning hanging tendrils	3	1,55	51,73	S
12	weeding weeds or grass around pepper plants	4	2,93	73,24	O
13	live jar pruning	3	1,07	35,56	I
14	Basic fertilization using organic matter	3	1,47	49,14	S
15	Inorganic fertilization is split at intervals of once every three months	4	2,35	58,70	S
16	fertilizing pepper plants that have not yet produced at a dose of 5-10 kg/plant and NPK fertilizer 600g/year/plant	4	1,46	36,48	I
17	fertilizing productive pepper plants 10-15 kg/plant and inorganic fertilizers 1-1.5 kg/year/plant	4	1,49	37,31	I
18	Inorganic fertilization by scraping (lifting) the surface layer of soil around the plant	3	1,30	43,21	S
19	carry out livelihoods of pests and diseases of pepper plants	4	2,44	61,11	O
20	Control of symptoms of borer pest attack is seen by removing/cutting and burning the affected plant parts	3	1,47	49,14	S
21	Control of symptoms of stunted/curly disease is seen by burning the affected plant parts	3	1,40	46,79	S
22	Control the occurrence of stem rot disease by burning and watering	3	1,51	50,49	S

No	Indicator GAP-GI	Score		TCR (%)	Category
		Interval	Average		
	fungicides made from copper oxychloride or bordo slurry				
	Total Score	75	39,17		
	Score Achievement			51,37	S

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**VO**)

Table 4 shows that the management stage of pepper cultivation applies Good Agricultural Practices-Geographical indications (GAP-GI) pepper, with a variable achievement rate of 51.37 per cent with categories sometimes (S) and Good Agricultural Practices-Geographical indications (GAP-GI) at the harvest and postharvest stages seen in Table 5.

Table 5

GAP-GI: Harvesting and Postharvest

No	GAP-GI indicator	Score		TCR (%)	Category
		Interval	Average		
1	harvesting with a characteristic reddish-yellow color	4	3,55	71,04	O
2	proper harvest time (age about 8-9 months)	5	3,72	74,44	O
3	harvesting several times during the harvest season	5	4,11	82,22	Vo
4	immersion in clean, running water	4	3,46	86,57	Vo
5	soaking in the Soaking Tub, and once every two days, the water is changed	3	0,36	11,98	N
6	Manual stripping of pepper in running water	5	4,00	80,00	O
7	pepper stripping using a threshing machine	3	0,23	7,65	N
8	drying using sunlight	4	3,64	91,11	Vo
9	drying by using a drying machine	3	0,23	7,78	N
10	sun-drying using a base or container	4	3,55	88,80	Vo
11	drying using shelves	3	0,29	9,63	N
12	drying in garden locations or places free from bacterial contamination	5	3,88	77,63	O
13	checking the dry moisture content of pepper with tools or manually	5	3,93	78,67	O
14	packaging using chemical contamination-free bags/containers/sacks	5	3,81	76,15	O
15	pepper storage in special warehouses/rooms and not united with fertilizer or pesticide storage	5	3,88	77,63	O
	Total Score	63	42,66		
	Score Achievement			61,42	Often

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**Vo**)

Table 5 shows that the harvest and postharvest stages in the application of Good Agricultural Practices-Geographical Indications (GAP-GI) pepper with a variable achievement level of 61.42 per cent with the category Often (O) and then the general conclusion of the application of Good Agricultural Practices-Geographical Indications (GAP-GI) pepper, can be seen in Table 6

Table 6

Implementing GAP-G) Lada by Farmers

No	GAP - GI	N	Max	Mean	TCR	Category
1	Land Selection and Processing	270	43	18,61	43,44	S
2	Plant Cultivation Management	270	75	39,17	51,37	S
3	Harvesting and Postharvest	270	63	42,66	61,42	O
					52.07	O

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**VO**)

Table 6, In general, the average behaviour of implementing GAP-GI Pepper with an achievement rate of 52.07 per cent in the category Sometimes means that farmers' practices in implementing good and correct pepper cultivation (GAP-GI) sometimes follow the recommendations in GAP-GI. GAP-GI practice at the selection and land processing stage amounted to 43.44 per cent. Generally, farmers sometimes apply this resistance according to the GAP-GI of pepper (shown in Table 3). When selecting and cultivating land categories, GAP-GI pepper often creates drainage in anticipation of the rainy season. At this stage, this category has never been the manufacture of mechanical drainage (using pipes and automatic timers). Meanwhile, the rare category is to choose land according to soil pH 5.5-6.5 (check soil pH).

Then, the Practice of managing crop cultivation by 51.37 per cent with the category Sometimes (S), meaning that in this stage, farmers sometimes apply according to the pepper GAP-GI (shown in Table 4). Applying GAP-GI pepper at the stage of management and cultivation of category crops often involves using seed sources from the garden, weeding weeds/grass around pepper plants, and conducting pest and disease livelihoods for pepper plants. At this stage, with the Rarely category of using a living trellis, the dose of fertilizer does not match the recommendations for plants that have not yet produced and productive plants. In comparison, several studies on Good Agricultural Practices on various commodities, such as Otara et al (2023), show the low adoption of Good Agricultural Practices regarding pests and diseases. However, the main problem of cashew production is pests and diseases. In line with research (Yekti & Suryaningsih, 2021), the application of Good Agricultural Practices for Rice in pest and disease protection, soil conservation, and cultivation is the lowest.

The harvest and postharvest stages of pepper cultivation activities amounted to 61.42 per cent with category often (O). Farmers usually apply the Good Agricultural Practices Geographical Indications (GAP-GI) recommendations in this stage (shown in Table 5). The application of GAP-GI Pepper at the highest harvest and postharvest stages in this category consists of harvesting, which is carried out several times during the harvest season, soaking using clean and running water, drying using sunlight, and drying using a base or container. Meanwhile, farmers do not implement the GAP-GI pepper recommendation or the never, namely, soaking in the soaking tub every two days while drying using a machine. Farmers often follow the recommendations of GAP-GI pepper because, at this stage, pepper

cultivation activities are over, so applying GAP-GI Pepper can determine the quality of pepper produced by farmers.

Applying Good Agricultural Practices (GAP) to various commodities from every country in the world has its challenges, as well as Nigeria's Practice. Using GAP in the value chain of ginger commodities has challenges, including marketing, knowledge about GAP itself, no organic ginger prices, and no production inputs available (Olaniyi, 2023). According to Adhikari & Thapa (2023), The results showed ten standards of good agricultural practices for apple plants, the largest crop of tumpeng sari practices adopted by farmers at 83 per cent, and the fewest irrigation methods. Then, implementing GAP on vegetable crops in Nepal reduced the use of chemicals by 40 per cent (Kharel et al., 2023). One of the more excellent propensity factors to adopt VietGAP (adopting good agricultural practices) is young farmers with higher education participating in credit and training programs and communicating with extension workers (Hoang, 2020). Then, the factors influencing GAP Thai Coffee farmers' confidence positively affect GAP. However, experience negatively impacts GAP understanding and lacks continuity of extension services even though GAP has been promoted (Pongvinyoo et al., 2014).

2. The Role of Agricultural Extension Workers in the Implementation of GAP-GI

Furthermore, extension workers have a vital role in providing farmers with knowledge and skills, especially in correctly and adequately cultivating pepper. Various roles performed by farmers: Table 7 shows the Role of Agricultural Extension Workers in Implementing Good Agricultural Practices-Geographical Indications (GAP-GI).

Table 7

Role of Agricultural Extension Officer in Implementing Pepper GAP -GI

No	Role of Extension Workers	N	Max	Mean	TCR	Category
1	Facilitator	270	57	26,23	45,92	S
2	Motivator	270	57	27,41	47,53	S
3	Educator	270	70	26,24	37,75	I
4	Consultant	270	73	26,90	38,31	I
5	Communicator	270	69	25,09	36,67	I
6	Mediator	270	61	19,94	34,58	I
					40,13	S

Information: Never (**N**); Infrequently (**I**); Sometimes (**S**); Often (**O**); Very Often (**Vo**)

Table 7 shows the average value of the role of agricultural extension workers is 40.13 percent with the category Sometimes, which means that the role of agricultural extension workers in implementing GAP-GI pepper is sometimes carried out by extension workers (extension workers have a role). The highest achievement value for extension workers as motivators is 47.53 percent, and for extension workers as facilitators, it is 45.92 percent, with occasional role categories. The lowest achievement rate of the role of extension workers as mediators are 34.58, and communicators are 36.67 percent with the infrequently category. The role of extension workers as motivators encourages and moves farmers to be willing and able to implement pepper GAP-GI. The role of motivators can be seen from the efforts of extension workers to encourage farmers to be active in farmer groups, by the function of farmer groups as a vehicle for learning classes, cooperation, and production units for their members. The motivation to participate in extension services to increase crop production is

influenced by peer farmer networks (Niu et al., 2022). The results of research by Thomas et al (2022) revealed that agricultural extension services and environmental conservation training on Good Agricultural Practices are not only provided to farmers but also to non-farmers

Meanwhile, according to Kamara et al (2021), there is a gradual change in the role of extension workers, with developing ideas about innovation as experts to become facilitators. Extension workers provide facilities or assistance to serve the needs of farmers. The role of a facilitator can be seen in extension workers facilitating meetings between farmers and related agencies related to pepper. The role of extension workers as consultants with an achievement level of 38.31 categories is rare, as can be seen from the activities of extension workers who provide solutions or advice related to planting media and good pepper breeding and provide solutions or advice so that farmers continue to plant pepper. The role of extension workers as educators with an achievement level of 37.75 with infrequent categories is to increase knowledge and skills, especially in providing planting media practices and pepper breeding and teaching the types of pepper seeds and their advantages. This indicates the importance of the role of extension workers as educators, in line with the research of Affandi et al (2022), which states that increasing livestock adoption among small ruminant farmers can be done by promoting their guidance, education, and evaluation of Practice. Then, According to Declaro-Ruedas (2019), In introducing new technologies and practices to farmers, extension workers use individual farm or home visits, group meetings, and information and communication technology (ICT).

Based on the level of achievement of the lowest extension worker role as a mediator and communicator with an infrequently category, an extension mediator has a role as a liaison between farmers and pepper stakeholders, and extension workers often connect farmers with other farmer groups and sometimes confronting farmers with district and provincial agricultural offices, especially in the plantation sector. According to Nwaobiala et al (2022), communication is essential as a carrier of information and knowledge among agrarian value chain actors. As in this study, extension workers as communicators must inform all information, primarily related to the assistance of production facilities such as fertilizers and agricultural machinery equipment. Extension workers serve as disseminators of information and technology and as motivators, dynamicators, consultants, and facilitators for farmers (Purwidyaningrum et al., 2021). Comparing the role of extension workers in sugarcane research and others, the results show that the role of extension workers is adequate in improving sugarcane farmers' economic performance (Rokhani et al., 2021). The function of extension workers as communicators in Research Abegunde et al (2020) The role of influencers as an essential source of information related to adaptation and resilience to climate change. Village Extension Workers (VEW) have a positive role as a source of pesticides grown by village traders (Hamad et al., 2019). The most frequently used communication of Nigeria's Oyo State extension workers consists of farmer contacts, farm visits, and home visits (Yekinni & Afolabi, 2019). Therefore, improving extension services effectively and of high quality is essential, as it can help smallholders increase their agricultural production (Shangshon et al., 2023). Finally, the role of extension workers is not only carried out by government institutions, but there is a partial shift in the role of private agricultural extension workers to public or farmer organizations or private institutions (Chand & Kumar, 2019).

Conclusion and Recommendations

This research contributes to implementing Good Agricultural Practices-Geographical Indications (GAP-GI) of pepper farmers and the increasing role of agricultural extension workers. The implementation of GAP-GI by pepper farmers, in general, is still low. Pepper farmers have not maximized (category sometimes) applied GAP-GI at the stage (pre-cultivation): selection and land processing, and stage (cultivation process): management of crop cultivation. However, pepper farmers have implemented GAP-GI well (frequent category) at the harvest and postharvest stages. In general, the role of agricultural extension workers in implementing Good Agricultural Practices Geographical Indications (GAP-GI) pepper has not been maximized (category sometimes). The role of agricultural extension workers as facilitators and motivators in categories is sometimes.

Meanwhile, the role of agricultural extension workers as consultants, communicators, and mediators in the category is rare. The implementation of GAP-GI Pepper by farmers has not been maximized, and the role of agricultural extension workers in GAP-GI has also not been maximized. Therefore, improving the practice of implementing GAP-GI pepper can be done by increasing the knowledge and skills of pepper farmers in the selection and processing stages and the integrated cultivation management stage. In addition, the government organizes special education and training for agricultural extension workers to improve competence so that they can carry out the role of extension workers optimally in implementing Good Agricultural Practices Geographical Indications (GAP-GI) pepper.

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