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Return to Traditional Wisdom in Controlling Maize Pests in Molamahu, Gorontalo, Indonesia

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Abstract

Government programs in agriculture, such as extension and seed and fertilizer assistance, have increased maize production, but also threaten the preservation of traditional wisdom. This article discusses intractable pest infestations as a major problem in maize farming in Molamahu Village, Gorontalo Regency, Gorontalo Province. Although many agricultural technologies have been developed, they have not been able to effectively control these pests. This study aims to explore the use of traditional methods by farmers in overcoming pest problems, as well as to demonstrate the effectiveness of local wisdom in this context. A qualitative approach was used by interviewing senior farmers and observing the practices of young farmers. The results of this study present clear and structured findings regarding the effectiveness of traditional methods in controlling maize pests. This study found that some traditional methods previously considered irrational turned out to have a robust scientific basis. These results confirm that local knowledge has great potential to strengthen eco-friendly pest control strategies in maize farming. The finding in this research underscores the importance of recognizing and utilizing local wisdom in the development of sustainable agricultural technology.

Program pemerintah di bidang pertanian, seperti penyuluhan dan bantuan benih dan pupuk, telah meningkatkan produksi jagung, tetapi juga mengancam kelestarian kearifan tradisional. Artikel ini membahas permasalahan utama dalam pertanian jagung, yaitu serangan hama yang sulit diatasi di Desa Molamahu, Kabupaten Gorontalo, Provinsi Gorontalo. Meskipun teknologi pertanian telah banyak dikembangkan, namun belum mampu secara efektif mengendalikan hama ini. Penelitian ini bertujuan untuk mengeksplorasi penggunaan metode tradisional oleh petani dalam mengatasi masalah hama, serta untuk menunjukkan efektivitas kearifan lokal dalam konteks ini. Pendekatan kualitatif digunakan dengan mewawancarai petani senior dan mengamati praktik petani muda. Hasil penelitian ini menyajikan temuan yang jelas dan terstruktur mengenai efektivitas metode tradisional dalam mengendalikan hama jagung. Dari penelitian ini, ditemukan bahwa beberapa metode tradisional, yang sebelumnya dianggap tidak rasional, memiliki dasar ilmiah yang kuat. Hasil penelitian ini menegaskan bahwa pengetahuan lokal memiliki potensi besar dalam memperkaya strategi pengendalian hama jagung yang ramah lingkungan. Implikasi dari penelitian ini adalah pentingnya mengakui dan memanfaatkan kearifan lokal dalam pengembangan teknologi pertanian yang berkelanjutan.

Keywords: eco-friendly practices; maize pest control; *mopo'a huta* ritual; sustainable agriculture; traditional wisdom

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Introduction

Government programs aimed at increasing agricultural production, including maize, have utilized fertilizers that have led to significant environmental impacts. Traditional wisdom offers concepts and methods for enhancing agricultural production; however, these approaches have been overlooked in the current context. Farmers often bear high production costs when adopting agricultural technology and must deal with pest attacks, which may cause crop failure (Asikin 2020). In addition, the emphasis on the effectiveness of technology in controlling pests often dominates farmers' mindset, leaving only little concern for traditional wisdom (Suparmini, Setyawati, and Sumunar 2015). Relative to technological solutions, traditional wisdom is often considered slow and irrational, which has decreased awareness of its application (Arjawa 2021). This perspective has largely overlooked the advantages of traditional wisdom, which is more environmentally friendly (Tamu and Dako 2018). Therefore, new initiatives aim to integrate pest management, combining biological and chemical approaches to reduce pesticide use (Stern et al. 1959) and restore eco-friendly traditional farming practices. It will become one of the solutions to the failure of modern agriculture to maintain ecological sustainability.

The results of previous research on implementing traditional agriculture to control plant pests can be grouped into three groups. First, most research highlights crop pests as a major challenge to improving maize yields (Sokame et al. 2021). Various technological approaches have been developed in an effort to overcome this problem (Sari 2018), one of which is the use of superior seeds that are resistant to pest attacks (Li et al. 2021). In addition, electronic pest control methods have also been developed to assist farmers in monitoring and controlling pest populations efficiently (Dinata and Hakim 2019). Crop rotation practices have also been encouraged to protect maize crops from rootworm pests. In this scenario, maize crops are temporarily replaced with other crops to reduce the risk of pest attacks (Sappington et al. 2018). These technological innovations are expected to help farmers reduce losses due to pests and maintain their maize yields.

Second, research has also identified various traditional practices used by farmers in their efforts to control pests, one of which is the ritual of repelling pests carried out by community groups in Kupang. Manafe (2020) observed that farmers in Kupang also conduct weed-clearing rituals, which have been considered effective in reducing plant pest populations. Meanwhile, in Javanese society, *tayub* rituals have been part of pest control strategies for many years, as noted by Suharji (2014). Similarly, in Lombok, *ngayu-ayu* rituals have been a common practice among farmers to overcome crop pest problems, as observed by Hadi (2019). In Muna, farmers do the *katingka* plantation ritual to deal with pest attacks, which has been perceived to be effective in reducing crop losses, as observed by Aswan and Jers (2018). In Gorontalo, the *mopo'a huta* ritual (a ceremony to fertilize the soil) has become an integral part of traditional agricultural practices to address crop pest problems, as noted by Pakuna et al. (2020). The finding showed that the traditional wisdom might have helped crop pest control in Gorontalo.

Third, research on integrated pest management (IPM), mostly aims to reduce toxic

materials, maintain natural predator populations, and emphasize sustainable and environmentally friendly control methods. For example, Mariyono et al. (2022). evaluated various IPM strategies to understand their effectiveness in controlling plant pests. One of the aspects analyzed was the use of natural enemies to control pest populations, which involves the introduction of predators or parasitoids that naturally prey on or kill plant pests.

In addition to traditional practices, this study also considers environmentally friendly cultivation techniques, such as crop rotation, intercropping, and using organic fertilizers to strengthen crop resistance to pest attacks. Thus, this research aims to reduce reliance on chemical pesticides and strengthen the overall agricultural ecosystem by restoring the balance between pests and their natural enemies.

This research seeks to address the shortcomings of previous research on pest management by examining the application of traditional agriculture and agricultural technology in controlling the invasion of maize pests. This research aims to answer three questions: 1) What are the traditional methods of controlling maize pests? 2) How effective is traditional agriculture in controlling maize pests? 3) What solution can be applied for environmentally friendly maize pest control? These three questions direct the investigation to understand whether the application of traditional agriculture—often considered irrational yet scientifically proven to be effective—can be an environmentally friendly option for maize pest control. This choice can reduce farmers' dependence on agricultural technology, which often poses health hazards to humans and the environment.

This article is based on an argument that controlling maize pests with traditional agricultural approaches is considered humanist and environmentally friendly, although it may be deemed irrational. Likewise, modern methods are believed to be effective in controlling pests. Still, they use harmful chemicals for humans and ecological sustainability, which also means destroying the pest's natural predators.

This study uses a qualitative approach to examine primary and secondary data on applying Gorontalo traditional wisdom as a pest control strategy. The primary data consists of various traditional agricultural wisdom and the practice of applying traditional wisdom in maize farming. The secondary data consists of data on the production and use of agricultural facilities. Overall, the analysis examines the relationship between maize pest control and the application of traditional wisdom.

This research involved two community groups: senior citizens with a wealth of traditional wisdom and productive farmers working on maize farms. A total of 12 farmers were actively involved in the study, selected based on their competence and experience in the application of traditional wisdom and maize pest control, as well as their belief in traditional wisdom and options for controlling maize pests. The participants included seasoned farmers who have been cultivating maize for several years and newer entrants to the field who brought fresh perspectives on pest management. The interviews aimed at identifying the farmers' choice of maize pest control methods and the underlying reasons, allowing for a comprehensive understanding of how traditional wisdom informs their agricultural practices.

The analysis to examine the relationship between maize pest control and the application of traditional wisdom went through several stages. The first is collecting observational data and interviewing farmers who adhere to traditional wisdom and use agricultural technology. Second, data from interviews with both categories of farmers were utilized to analyze the relationship between maize pest control and the application of traditional wisdom.

The data analysis was conducted in three stages. The first is data reduction, which arranges data more systematically, especially thematically. The second is displaying data to present the narrative excerpts from interviews and observations. The third is data verification, which discusses and concludes the trends from the data obtained. The data processed through the three stages are analyzed descriptively and then interpreted contextually. The stages of analysis and analytical techniques used allow the formulation of conclusions on the relationship between maize pest control and the application of traditional wisdom. Based on the research stages, the results and discussion are presented as follows.

Traditional Ways of Maize Pest Control

Traditional wisdom is a way of life believed and practiced by traditional communities to regulate aspects of their lives in an equal relationship with fellow humans, nature, and spirits.

> "For us, traditional wisdom is the ultimate guide to life. We believe these beliefs are the foundation for a balanced life between humans and nature. Maintaining this balance is essential to ensure our prosperity on earth." KM, interview, December 23, 2020).

> "We believe that a good relationship with nature is not only important for now, but also for our future. Traditional wisdom helps us maintain a harmonious relationship between humans and nature. It includes local knowledge held by community leaders and all of us, which we consider very important." (PS, interview, January 6, 2021).

> "We apply agricultural practices full of wisdom and sacredness in certain rituals. It is all a result of our creative intelligence and traditional knowledge as a farming community. We strongly believe that properly carrying out the processes and stages of farming is very important to obtain maximum benefits. Similarly, we also believe that if not done well, disaster risks exist. Therefore, we always strive to carry out our farming practices carefully." (BD, interview, December 12, 2020).

The statements above capture how traditional wisdom is a way of life believed and practiced by traditional communities to regulate aspects of their lives in an equal relationship with fellow humans, nature, and spirits. This belief is an important principle and value in the traditional society to create balance (Keraf 2002). The statements also encapsulate the importance of maintaining a harmonious balance between humans and nature and the health of nature for human prosperity (Wang et al. 2021; Zingraff-Hamed et al. 2021). Thus, traditional wisdom that contains intelligence, creativity, and local knowledge of community leaders and their followers is the key to a harmonious relationship between humans and nature.

Agricultural ritualistic practices full of wisdom and sacredness result from creative intelligence and traditional knowledge of the farming community (Yanti, Basri, and Suraya 2018). The rituals are regularly practiced in different stages of agricultural activities (Harnita and Anwar 2018). They believe proper implementation of the rituals will bring benefits;

otherwise, it will bring disaster upon the cultivated crops (Vermander 2021). Farmers in Gorontalo anticipate these dangerous threats by regularly holding the *mopo'a huta* ritual. They believe that the ritual brings about harmony among living things. They conduct the *mopo'a huta* ceremony by dancing *(dayango),* singing (*wumbungo)* accompanied by drumming *(towohu),* then inviting spirits by burning incense *(molapo)*, giving offerings *(hantalo),* and ending with prayer *(mongadi salawati)*. The essence of this ritual is to summon spirits to accept the offerings and to plead to them not to disturb the crops by spreading pests (Hunowu et al. 2020; Hunowu and Pakuna 2020).

In addition to holding the collective *mopo'a huta* ritual, there are small rituals that are carried out by farmers individually on their respective farms. There are also taboos that farmers must avoid during agricultural rituals. Adhering to these rules will bring agricultural success and prosperity (Silvi, Lumangkun, and Wardenaar 2017).

The senior farmers believe that plant pests come from supernatural causes. Spirits create these plant pests to disturb humans. Therefore, supernatural pest control is required as well, namely by holding rituals to provide ransoms to the spirits so that they do not harm the crops using plant pests. This belief is captured in the following interview excerpts:

> "Plant pests are the devil's creation, so their emergence is massive; for example, mice and caterpillars. Therefore, the growth of mice and caterpillars in groups is hard to believe. The number of caterpillars in a single maize tree is up to ten, with ten mice in one hole. Mice and caterpillars come alternately; their attacks can consume a bed of maize overnight. Caterpillars eat the leaves, and mice eat the cobs." (KM, interview, Desember 23, 2020).

In another interview with senior farmers, the *mopo'a huta* ritual is seen as an integral part of their cultural heritage that has been passed down from generation to generation. They believe this ritual has a strong spiritual power to protect the maize crop from pests and maintain the fertility of the farmland. For these senior farmers, the *mopo'a huta* ritual has a deep meaning, not only as a traditional practice but also as a close bond with nature and the wisdom of their ancestors. They feel that keeping and preserving this ritual is important to maintain the balance between humans and nature and to pass on ancestral values and traditions to future generations.

For the senior farmers, pest attacks that come in turn are caused by the objection of ancestral wisdom by the society. Pests are believed to be created by spirits to disturb humans, which can be prevented by giving them offerings. The offerings can be delivered communally or individually, as reflected in the following statement:

> "Offerings to spirits for the common good are delivered by holding a *mopo'a huta* ritual. The ceremony is held for seven nights, and dances and songs are sung, accompanied by drumming. Spirits will possess the dancers and will express their wishes. On the last day, offerings will be provided to fulfil the request with an agreement that it will not disturb humans. Individual farmers can provide offerings in the form of betel nut and cigarettes on *woka* leaves while conveying to the spirits so as not to disturb humans." (PS, interview, January 6, 2021).

Organizing a ceremony communally is challenging, so the senior farmers carry it out individually on their respective lands. In addition to individual offerings, farmers burn incense around their farms, as stated by the following farmer:

> "There still farmers who burn incense in the middle of the farm so that the spirits carrying plant pests will immediately move away. As such, they can cultivate their crops without pest disturbance. The incense is burnt in four maizeers of the farm, and some is simply placed in the middle of the farm. This is done when the maize is starting to produce cobs." (KM, interview, December 23, 2021).

In addition to repel pests, incense is also burnt to invite spirits to guard their land. However, this method is considered dangerous and has been abandoned, as stated by a farmer who used to practice it.

> "In the past, my farm was guarded by four spirits. I invited them by burning incense, then asked them to keep an eye on the farm from pests. However, the four spirits repel pests and harm residents who accidentally enter the farm, causing diarrhea. I have abandoned this method because people were paralyzed in the garden, unable to get up, before I gave them water." (BD, interview, December 12, 2020).

In addition, farmers protect their maize plants from pests by rubbing white bamboo reeds in the middle of the farm. One farmer who applies it stated:

> "My father used to rub white bamboo reeds around the farm routinely and then stuck the two ends of the bamboo reeds in the middle of the garden. I have tried that method, but I initially felt the impact. Over time, it did not have an impact. Maybe there was an error in applying it." (KD, interview, January 6, 2021).

Most farmers also observe a good day to plant *(panggoba).* Although some consider this method ineffective, some believe it can suppress maize pests, as stated by the following informant:

> "Choosing a good day to plant is very influential on the growth and development of maize. I have seen two adjacent maize fields, one farm showing fertile maize plants without pests, the other being attacked by pests. After being traced, it turns out that the garden owner whose maize thrives was very disciplined in determining the good day to plant." (PU, interview, December 18, 2020).

The traditional wisdom of determining auspicious days to plant is well documented, involving astrology and tabulation for choosing the days. The farmers use as a reference described in Table 1.

Table 1 shows the good plating day by crop type. Only senior farmers observe good planting days. Neglecting the good days will result in the creation of plant pests. However, this belief has been refuted by modern young farmers who believe that plant pests naturally grow, just like other creatures. Such differences in beliefs have influenced the way farmers control pests (see Table 2).

Table 1
Planting Days and Plant Types

Days	Days Plant Type
Sunday	Bearing fruit in the middle and above
Monday	Bearing fruit in the ground
Tuesday	All kinds of plants
Wednesday	Flowering plant
Thursday	Seed plant
Friday	All fruit bearing plants
Saturday	Local plants

Source: Farmer's Documentation

Table 2
Ways taken by Farmers to Control Maize Pests

	Confidence	Effort
Traditional	Pests are the creations of spirits	Holding a *mopo'a huta* ritual to compromise with the spirits
	Pests are creatures of God	Caterpillars and mice are controlled by *molapo* and white reed rubbing
	Good and bad days	Planting maize on a good day and hour
Modern	Pests disturbing plants	Using superior seeds, fertilizers, and pesticides to control it
	Pests are the enemy of farmers	Exterminated/controlled by the application of technology (superior seeds, fertilizers, and pesticides)
	All days are good days	Planting maize when the land is ready to plant

Source: Processed Interview Results

Table 2 illustrates that different beliefs affect the adoption of maize pest control. The results show that older farmers tend to rely on traditional and mystical methods, while younger farmers opt for modern technology. The groups evaluate each other's pest control methods based on the rationality and costs. Previous research on the role of religious culture in preserving the natural environment has shown that religious values and local traditions can effectively maintain ecosystems (Hallatu et al. 2020). The result of this study confirms the previous study's findings. Although there are differences in approaches between older and younger farmers in maize pest control, they underscore the importance of under-standing and respecting people's cultural beliefs and practices in environmental conservation efforts.

The Effectiveness of Traditional Agriculture in Controlling Maize Pests

To understand how traditional farming practices remain effective in controlling maize pests, interviews with several senior farmers were conducted to explore their experiences and views on the use of traditional methods compared to modern technology.

> "We are now starting to turn more modern, especially in the agricultural sector. we use technology such as harvesting machines, hand tractors, and other advanced technologies. These technologies make our work easier and faster, and we can get more out of their crops. However, using these technologies also brings about big changes in our lives. We consider that new technologies are the solution to improve farmers' welfare because they can increase maize production. However, using technology also means using good seeds, fertilizers, pesticides, and herbicides so that the plants can grow well and be protected from pests and diseases." (PU, interview, December 18, 2020).

The statement above implies that transforming traditional farmers' lives into modern ones is increasingly visible, especially in the application of technology in the agricultural sector. The transformation began when technologies such as harvesting machines, hand tractors, and other cutting-edge technologies were introduced. Technologies in the agricultural sector have made farmers' work easier, faster,

and more productive (Kirkpatrick 2019), which creates a fundamental change in the agricultural sector and the economic life of farmers (Scott 2000; Yuliatmoko 2012). The farmer also believes that the use of the latest technologies in the agricultural sector is the right solution for the welfare of farmers, as they can increase maize production, which aligns with a previous study by Muhammad (2008). In fact, technology also encourages the adoption of other technologies, such as high-quality seeds, fertilizers, pesticides, and herbicides, in line with Emerick (2018). In this case, the plants will grow well and be free from pests and plant diseases, resulting in high production.

Both the traditional and modern farmer groups claimed that their methods of controlling plant pests were the most effective. However, both traditional and modern methods have their own weaknesses and strengths, as shown in the arguments below:

> "When I was a child, I rarely saw pests, now they are unbelievable, very numerous and difficult to understand. I think this is due to the treatment of modern farmers who glorify technology. Meanwhile, what I heard from old people is that these pests are brought by spirits, the way is to persuade spirits through the ritual of *mopo'a huta*, providing offerings according to their wishes. Traditional methods do not hurt other living things, maize thrives without pests compared to modern ways. Thousands of caterpillars and grass-hoppers are killed by spraying. After that, more appeared. People's beliefs used to have some truth; the spirits showed their power." (KM, interview, December 23, 2020).

> "Controlling pests with rituals is irrational. By contrast, getting rid of pests with pesticide sprays is very rational, simple, and immediately proven, while there are many traditional methods that must be provided but the results are not immediately visible. I even saw for several times the *mopo'a huta* ritual was carried out but the pests still came to attack." (IDJ, interview December 20, 2020).

> "Agricultural technology cannot always control pests, such as mice and downy mildew. There are often too many mice to control with poison. Meanwhile, downy mildew must be uprooted and separated from plants that have not been infected. The extreme way is to ask for the help of spirits, but the risk is great as it can harm humans." (BD, interview, December 12, 2020).

> "I routinely spray herbicides every planting season. The soil looks increasingly arid, so it must be given fertilizer to make it fertile. When the rain has not fallen in a short while, the ground looks cracked. It may be the effect of poison, even though it was not like this before. The soil is loose, especially every season the grass is burned after being slashed into natural fertilizer. Now we have to use chemical fertilizers. Everyone uses it, what else." (BB, interview, December 20, 2020).

Table 3 compares traditional and rational (modern) methods of controlling maize pests. The results showed that the two methods applied by farmers had their respective weaknesses and strengths. The differences between traditional wisdom and agricultural technology are stark in certain aspects. The reliability of traditional wisdom is largely determined by communal adherence.

Meanwhile, the reliability of agricultural technology is determined by the individual's compliance to the instructions for use. The *mopo'a huta* ritual requires all citizens' communal effort to comply with the required taboos. The efficacy of the *mopo'a huta* ritual lasts one to five years, while technologies must be applied regularly in every season. Individual obedience in applying technology requires certain knowledge, with some farmers believing that more frequent spraying is the key to successful plant pest control. This has caused the soil to lose nutrients and killed natural predators (Sokame et al. 2021), making pests increasingly difficult to control.

Table 3
Comparison of Traditional and Modern Pest Control

Traditional Ways	Modern Ways
Eco-friendly (humanist)/extreme (harmful to humans)	Damage the environment (soil and natural predators), poison humans
The *mopo'a huta* ritual is carried out communally, rubbing bamboo reeds and burning incense individually	Spraying is done individually
Many ingredients (offerings, bamboo reeds, incense) are prepared and available in nature	Not much to prepare and have to buy
The effect is slow but significant	The effect is immediate and must done repeatedly
Few adherents	Many adherents
Hard and tiring	Easy and effective

Source: Processed Interview Results

Table 3 shows significant differences between traditional and modern pest control methods, with traditional methods being more environmentally friendly but requiring more time and effort, while modern methods offer quick results but often have negative impacts on the environment and human health. This comparison highlights the dilemma farmers face in choosing between nature conservation and short-term efficiency.

An Environmentally Friendly Solution to Maize Pest Control

Farming communities face a dilemma in choosing between maintaining traditional practices that are more environmentally friendly and switching to modern agricultural technologies that are considered more efficient. Most farmers feel that modern technology provides faster and easier results, but they are also aware of the negative impacts such as environmental damage and increased pest resistance. For example, interviews with farmers revealed that they are starting to lose faith in traditional practices due to economic pressures and demands to increase yields. A senior farmer revealed, "We are forced to use pesticides and new technologies for fear of losing yields, even though we know it risks damaging the soil and killing beneficial insects." (BB, interview, December 20, 2020). In contrast, some young farmers see modern technology as the only way to survive the market competition, but still consider reusing some elements of local wisdom that they feel are effective and safe.

The complexity of the problems faced by farmers in controlling pests that come on a massive scale has forced farmers to abandon traditional wisdom and switch to using agricultural technology (Vermander 2019). The application of maize farming technology further drives the loss of traditional agricultural wisdom. Environmentally friendly traditional wisdom is considered to hinder progress and acts of shirk (idolatry or polytheism) (Pakuna et al. 2020). Meanwhile, the application of technology is not the only solution in agriculture. In certain farming communities, they cultivate agriculture

without being supported by the convenience of technology (Lestar 2018).

One of the principles of traditional agriculture holds that humans should give full attention and respect to nature as living beings (Kraalingen 2019). This is the basis for traditional farmers to always maintain harmony with nature through agricultural rituals (Hunowu et al. 2020). Plant pest attacks occur as an implication of objecting the values of traditional wisdom. This wisdom views that the soil as the source of all life is sacred (Kraalingen 2019). Meanwhile, modern farmers view that pesticides are the only means to control pests. Pest attacks that threaten harvests prompt farmers to schedule spraying. However, their limited knowledge of the application methods, such as the dose and concentration, the active ingredients, the side effects on natural predators and the environment, has led to a detrimental effect. Pests become resistant; their populations are increasing; the environment is polluted; and the natural predators are killed (Indiati and Marwoto 2017).

The action taken by the Indonesian government is to declare integrated pest control, namely integrating biological control with chemical control (Stern et al. 1959) with the aim of minimizing the use of pesticides (Mariyono 2008). One of the principles of integrated pest control is the preservation of natural predators of plant pests and diseases. Natural predators are one of the important factors in controlling plant pests and diseases. Therefore, natural predators must be conserved and managed in order to play a maximum role in maintaining the balance of pest populations in the ecosystem. Some of these natural predators are spiders, dragonflies, praying mantis, ladybugs, beetles and tomcats (Sari, Rahmawati, and Samrin 2020).

The problem of pest attacks remains pervasive and farmers need to find a viable solution to increase their maize production as programmed by the government (Thomas, Hislope, and Aslakson 2019). This study examines the relationship between maize pest control and the application of traditional wisdom for three reasons. The first is the application of agricultural technology is widespread and the impact is also wider. By contrast, the application of traditional agriculture has been at a crossroads. On the one hand, it is considered functional in overcoming plant pests but, on the other hand, it has not received serious attention. Second, not much attention has been paid to the analysis of the relationship between maize pest control and the application of traditional wisdom. Previous studies have shown the dominance of agricultural technology and the weakening of traditional wisdom but did not specifically examine if the benefits of traditional wisdom can be reconsidered. Third, most studies focus on agricultural technologies, which increasingly threaten ecological sustainability. It is important to rethink the application of traditional wisdom in controlling maize pests. Traditional methods that can be empirically proven can be developed as an option for environmentally friendly pest control. Therefore, understanding the relationship between maize pest control and the application of traditional wisdom is crucial and urgent to inform decision-making to reduce the use of environmentally-harmful agricultural technology. This can be done by applying a hybrid approach to maize farming.

Farmers in the traditional group and modern group have indicated that their approach has unique strengths and weaknesses. The results of the study in Table 3 illustrate that some of the weaknesses of traditional

agriculture can be complemented by modern agriculture, and vice versa. This suggests the possibility of integrating these two methods with the assumption that the approaches can complement each other. Some farmers (old and young) have integrated these two methods. In addition to applying agricultural technology, they also consider traditional wisdom that can be done independently, for example paying attention to the right time to plant.

> "My observations during farming, plant pests must be resolved in two ways; maximizing the legacy of the ancestors, for example by being patient in waiting for the right time to plant, while using superior seeds and fertilization, controlling pests with pesticides if urgent. In these ways, my harvest is abundant." (PU, interview, December 18, 2020).

> "I tried to combine the ways of the old people with modern ways, for example seeing the right time to plant, fumigating the plants after they produce corn silk. Using superior seeds because local seeds are no longer available, fertilizing, and if there are pests roaming around, I also spray chemical drugs. With these methods, I have had several successful harvests without any significant disturbances from the plant pests." (BB, interview, December 20, 2020).

The results of the research found that there are various traditional farming methods that are still applied by older farmers. This shows that technology cannot fully solve the problem of plant pest control. The results also suggest that reconsidering the application of traditional wisdom could reduce farmers' dependence on technology. One example is the use of superior seeds that require fertilizers and pesticides, especially the use of pesticides that threaten the ecology. This condition made it possible to integrate traditional wisdom with limited agricultural technology so that pest control is more environmentally friendly. The application of this hybrid knowledge is in line with integrated pest control techniques (Stern et al. 1959).

Rubbing white bamboo reeds and burning incense in the middle of the field *(molapo)* are two traditional methods that are considered scientifically acceptable. First, rubbing white bamboo while reciting a spell produced a creaking sound which Reuter and Oehler (2011) proved could cause discomfort. The friction of the two bamboo blades could cause a physical reaction that causes a significant change in the conductivity of the skin. The same reaction is thought to be felt by caterpillars and mice that were attacking maize. Second, burning incense in the middle of a field aims of repelling the ghosts carrying maize pests. In reality, the puffs of smoke hit the maize plants. Fumigation of plants has been scientifically proven to maximize shoot growth and control wilt disease (Nuryani et al. 2016). Hadi (2021) stated that fumigation could minimize pest populations. In brief, previous research has shown that the application of traditional wisdom may be in line with the scientifically proven methods.

This research has also shown that farmers' efforts to control maize pests determine the choice of traditional or rational maize control. The old farmers chose traditional ways through certain rituals, both communal rituals *(mopo'a huta*) and individually *(*swiping white bamboo*, molapo* and *panggoba).* Young farmers prioritize the use of technology as a rational choice, such as planting superior seeds, fertilizing, and spraying pesticides on pests. This indicates that agricultural technologies have not been able to solve the pest problem. The emergence of increasingly massive pests made the old farmers return to traditional wisdom. The reliability of traditional wisdom could be

reconsidered to control pests that could not be solved scientifically.

Traditional methods applied by farmers are choices that are not only environmentally friendly, but also uphold harmony with all of God's creation. By contrast, agricultural technologies are often not humanist, kill other living things in an instant, and encourage farmers to clear land on hillsides, for example, to support the planting of hybrid maize varieties with strong root structures (Hunowu et al. 2021).

In short, agricultural technology is not the only alternative in controlling maize pests. In certain situations, traditional wisdom still has potential. The principle of harmony with nature in the perspective of wisdom means that repelling pests traditionally must preserve nature. This is contrary to the application of technology that kill pests en masse. The enemy for traditional farmers does not have to be destroyed but simply conquered. Conquering pests for traditional farmers can be done naturally through certain rituals so that the process of controlling pests is not by killing them using chemical substances.

Scientifically, natural enemies play an important role in controlling pests in agriculture (Sokame et al. 2021). Plant pests occur naturally when their natural enemies become extinct, caused by the overuse of toxic chemicals. The more often pests are destroyed by chemical means, the greater the increase in their population (Zhang et al. 2019). As a result, new plant pests that are more resistant to these chemicals are emerging.

Conclusion

This study reveals a critical shift in understanding pest control in maize cultivation. While the government's focus on increasing production has led to widespread adoption of agricultural technologies, the over-reliance on these technologies, particularly through the excessive use of pesticides, has paradoxically escalated the very problem they were meant to solve—pest resistance and population growth. This counterproductive outcome underscores a pivotal finding: the incorporation of traditional wisdom in pest management is not merely an alternative but a necessary complement to existing technologies, offering a more sustainable path forward. By examining the perspectives of traditional farmers who interpret pest attacks as manifestations of nature's anger, this study uncovers a deeper ecological insight often overlooked by conventional scientific approaches. These farmers' practices, which align with ecological balance and minimal chemical intervention, suggest a nuanced understanding of pest dynamics that could revolutionize current pest control strategies. The study suggests that a hybrid approach, blending traditional wisdom with modern agricultural technology, could offer a breakthrough strategy that not only enhances pest management but also aligns with sustainable agricultural practices.

However, this study has several limitations, particularly in providing an in-depth analysis of how traditional wisdom can be effectively integrated with environmentally friendly pest control practices specific to the context of Gorontalo. The research is primarily exploratory and does not sufficiently address the complexities involved in combining local practices, such as the use of natural repellents or pest management rituals, with scientifically validated, modern methods like biological pest control or integrated pest management (IPM).

Additionally, this study has not examined the socio-economic factors, such as local farmers' access to resources, education, and technology, that may influence the adoption of a hybrid approach. These factors are crucial to understanding the feasibility and scalability of integrating traditional wisdom with contemporary methods across different farming communities in Gorontalo.

The limitations of this study open up significant opportunities for further research to investigate the integration between environmentally friendly agricultural technology and traditional wisdom in pest control. Future research could focus on conducting empirical studies that assess the effectiveness and practicality of a hybrid pest control model in real-world farming conditions. This could include field trials comparing crop yields, pest resistance, and ecological impacts between conventional, traditional, and hybrid methods. Moreover, studies could explore how local cultural practices and beliefs can be systematically documented and preserved, and how these practices can be adapted to align with modern sustainable agriculture techniques. Researchers could also investigate strategies to facilitate the broader adoption of hybrid pest control approaches, including education programs, farmer training workshops, and policy support, to ensure these practices are sustainable, economically viable, and culturally appropriate in Gorontalo and other regions facing similar agricultural challenges.[]

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