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Analyze Farmers' Attitudes, Skills, and SDG Achievements through the Production of Organic Fertilizer from Corn Cobs

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Abstract: *Unutilized corn cob waste damages the environment and reduces land sustainability. Processing it into organic fertilizer can support a circular economy and reduce waste. This study aimed to analyze the attitudes, skills, and achievements of farmers' SDGs in processing corn cob waste into organic fertilizer. The method used was counseling and training for 30 farmers. The instrument used was a questionnaire to measure attitudes and skills, with ten items each. The results showed that there was a significant increase in farmers' attitudes and skills, respectively, with an average score of 0.994 (very accepting category) and 0.993 (very skilled category). The findings concluded that counseling and training could improve the positive attitudes and skills of farmers in processing corn cob into organic fertilizer. Thus, the objectives of the Sustainable Development Goals related to food security, environmental protection, independent and competitive farmer groups, and local economic growth in Pakpak Bharat could be achieved.*

Keywords:
Attitude; Skills; Organic Fertilizer; SDGs; and Corn Stem Waste

Introduction

After rice, corn (*Zea mays* L.) is the second largest food crop in Indonesia and is very important for the country's food security.[1] In addition to being the main source of protein and carbohydrates after rice, corn is also the raw material for animal feed and a number of other processed products. With 355 kcal of calories, 9.2 g of protein, 3.9 g of fat, 73.7 g of carbohydrates, and 10 mg of calcium, maize has a high nutritional value. Corn also contains a number of other health-supporting components. According to Asri and

[1] Abdelrehim A. Ali, "Maize Productivity in the New Millennium," in *Mitigating Environmental Stresses for Agricultural Sustainability in Egypt* (2021): 509–535.

Surtina, corn has often been processed in Indonesia into flour, corn rice, and components of fish and livestock food. Nevertheless, farmers were encouraged to increase their production due to the high demand for corn from fodder producers and the flour sector.[2] To meet this market demand, farmers expanded their corn plantations.[3] During harvest season, maize plants produce waste such as klobot[4] and corn cob.[5]

Among agricultural residues, corn cobs are an important residue of corn.[6] Corn cob is the waste obtained after threshing the corn kernels. Most farmers typically dispose of or burn these corn cob residues,[7] As shown in Figure 1. The chemical composition of the harvested corn cob residue is actually 10% protein, 4% fat, 61% carbohydrate, 1.4% sugar, and 0.4% other materials.[8] Many farmers are unaware that corn cob can be processed into organic fertilizer.[9] Farmers can receive additional benefits if this waste is utilized.

Figure 1. Corn Cob Waste Burned

[2] Alfian Asri and Dara Surtina, "Pengaruh Penggunaan Tepung Beras dan Tepung Daun Singkong dalam Ransum Burung Puyuh (Coturnix coturnix japonica) terhadap Performan Awal Produksi," *Jurnal Ilmiah Bareh Solok* 8, no. 1 (2023): 23–33.

[3] Shanti Veronika br Siahaan and Yeremia Niaga Atlantika, "Strategi Penggunaan Dana Desa untuk Meningkatkan Perekonomian Masyrakat Melalui Kegiatan Bumi Desa Pasti Jaya Abadi Desa Pasti Jaya," *PUBLIK: Jurnal Manajemen Sumber Daya Manusia, Administrasi dan Pelayanan Publik* 9, no. 3 (2022): 611–626.

[4] K. W. Prasetiyo et al., "The Potential of Using Agricultural Waste: Corn Husk for Particleboard Raw Material," *IOP Conference Series Earth and Environmental Science* 591, no. 1 (2020): 012011.

[5] Romiyanto and Leony Agustine, "Sosialisasi Pembuatan Pupuk Organik Tongkol Jagung," *Jurnal Pengabdian kepada Masyarakat Nusantara* 5, no. 2 (2024): 2166–2171.

[6] Ji Yong Choi and Jihee Nam, "Utilization of Corn Cob, an Essential Agricultural Residue Difficult to Disposal: Composite Board Manufactured Improved Thermal Performance Using Microencapsulated PCM," *Industrial Crops and Product* 183 (2022): 114931.

[7] Nurliani Nurliani, "Pelatihan Pembuatan Pupuk Organik untuk Peningkatan Pengetahuan Petani di Desa Kale Ko'mara Kabupaten Takalar," *Nanggroe, Jurnal Pengabdian Cendekia* 3, no. 12 (2023): 384–391.

[8] Romiyanto and Leony Agustine, "Sosialisasi Pembuatan Pupuk Organik Tongkol Jagung," *Jurnal Pengabdian kepada Masyarakat Nusantara* 5, no. 2 (2024): 2166–2171.

[9] Blasius Doni Yoga and Regina Septiana Barung, "Kekayaan Potensi Desa Pengasih," *Jurnal Atma Inovasia (JAI)* 1, no. 2 (2021): 130–137.

Corn cob waste, which includes the lower stalks and roots, is often overlooked and not optimally utilized by farmers,[10] However, it has the potential to serve as a beneficial natural material, enhancing soil nutrients through the production of natural products.[11] The use of organic fertilizer made from corn cob waste not only helps reduce farmers' production costs but also contributes to environmentally friendly and sustainable farming practices. However, farmers' attitudes and skills in utilizing corn cob waste as organic fertilizer remain limited, potentially leading to environmental pollution. Numerous studies have explored the conversion of agricultural waste into organic fertilizer, such as rice straw waste,[12] household waste,[13] and empty palm oil fruit bunches,[14] And others.

Pakpak Bharat Regency, as one of the main corn-producing areas, had yet to optimize the utilization of corn cob waste fully. Most farmers lacked the skills to process this waste into valuable products. According to Candra et al., farmers' abilities to manage their agricultural enterprises varied greatly, depending on individual knowledge, attitudes, and skills. Increasing farmers' knowledge and skills in utilizing agricultural waste was essential to maximize the potential of available resources.[15]

Farmer education and training on processing corn cobs into organic fertilizer were expected to significantly long-term impact the achievement of the SDGs. By improving soil quality and reducing reliance on industrial fertilizers, this practice contributed to food security (SDG 2) and environmental protection (SDG 15). Additionally, this training promoted the formation of independent and competitive farmer groups, contributing to poverty alleviation (SDG 1) and local economic growth (SDG 8) in Pakpak Bharat Regency.

Method

This activity was implemented in Surung Mersada Village, Kerajaan District,

[10] Siti Walidah Mustamin and Saifuddin Amin, "Potensi dan Penerapan Pengolahan Limbah Jagung sebagai Pakan Ternak," *Prosiding Webinar Nasional Integrasi Hasil Riset Untuk Kegiatan Pengabdian Masyarakat (PKM) dalam Peningkatan Kesejahteraan* 1 (2023): 55–59.

[11] Sahid and Bagus Wahyu Utomo, "Peningkatan Teknologi Mesin Pencacah Tongkol Jagung dan Mixer untuk Meningkatkan Produksi Pupuk Organik pada Kelompok Tani Desa Jragung," *SITECHMAS: Jurnal Hilirisasi Teknologi kepada Masyarakat* 4, no. 2 (2023): 106–119.

[12] Hala M. Omar and Yahla I. Mahmoud, "Sustainable Bio-Conversion of Rice Straw Waste into High Quality Organic Fertilizer," *Journal of Environmental Protection* 11, no. 4 (2020): 315–331.

[13] S. Suparti et al., "Utilization of Household Waste into Liquid Organic Fertilizer: Empowering Community Collaborated with Muhammadiyah Branch Office of Colomadu Karanganyar Indonesia," *Journal of Community Service and Engagement* 2, no. 2 (2022): 30–35.

[14] M. Surya Hidayat and Abdurrozzaq Hasibuan, "Pemanfaatan Tandan Kosong Kelapa Sawit Sebagai Bahan Pupuk di PT Karya Hevea Indonesia," *Factory Jurnal Industri Manajemen dan Rekayasa Sistem Industri* 1, no. 2 (2022): 52–58.

[15] Muh Haerul Candra, Musadar, and Putu Arimbawa, "Tingkat Pengetahuan dan Keterampilan Petani pada Usaha Tani Nilam dalam Upaya Peningkatan Pendapatan di Desa Sambahule Kecamatan Baito Kabupaten Konawe Selatan," *JIPPM: Jurnal Ilmiah Penyuluhan dan Pengembangan Masyarakat* 2, no. 4 (2022): 226–232.

Pakpak Bharat Regency. It involved counseling and training 30 farmers. The instrument used was a questionnaire with 10 items each measuring attitudes and skills. The steps of the activity included counseling, training, and evaluation (Figure 2).

Figure 2. The Steps of Activity

Counseling

The counseling activity was conducted through material presentations, discussions, and guidance provided by expert speakers in the field of agriculture (Figure 3). Before the activity began, a questionnaire was distributed to assess the participants' attitudes and skills.

Figure 3. Counseling Activity with Farmers

Training

The training activity involved farmers through demonstrations on processing corn cob waste, as shown in Figure 4. A total of 30 corn farmers participated in this activity. Farmers were encouraged to ask questions freely. Additionally, they were asked to actively engage in every stage of the training, from preparing the materials to the process of making organic fertilizer.

Figure 4. Training Activity with Farmers

Evaluation

Data analysis regarding corn producers' attitudes and skills in processing corn cobs into organic fertilizer was conducted at this stage. A questionnaire was used to analyze the two variables: the attitudes and abilities of corn farmers, measured using a Likert Scale with five response categories, assigned values ranging from 1 to 5. The total scores for attitudes and skills were calculated using the formula in Equation (1) and then averaged using Equation (2).

$$\text{Total score} = \frac{\text{farmer's response score} \times \text{number of respondents}}{\text{maximum response score}} \quad \text{Eq.(1)}$$

$$Average\ score = \frac{\text{total score}}{\text{total questions}} \quad \text{Eq. 2)}$$

Next, the assessment criteria for the attitudes and skills of corn farmers were analyzed (Table 1).

Table 1. Assessment Criteria for Attitudes and Skills

Average Score	Attitude/Skill Criteria
0.81 – 1.00	Very Accepting / Very Skilled
0.61 – 0.80	Accepting / Skilled
0.41 – 0.60	Unsure / Less Skilled
0.21 – 0.40	Not Accepting / Not Skilled
0 – 0.20	Very Not Accepting / Very Not Skilled

Result

The research results showed a significant improvement in farmers' attitudes and skills, with average scores of 0.994 (very accepting category) and 0.993 (very skilled category), as shown in Figure 5.

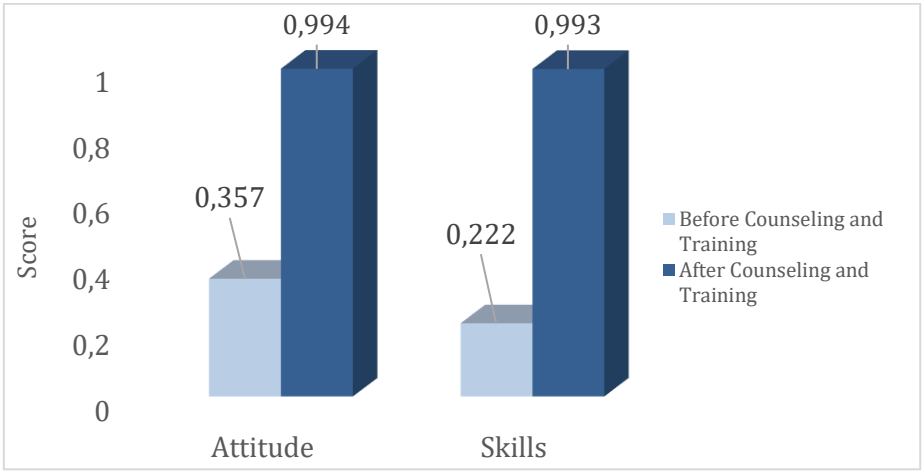

Figure 5. Assessment of Attitudes and Skills

This data (Figure 5) proved that counseling and training improved farmers' positive attitudes and skills in processing corn cobs into organic fertilizer.

Discussion

Attitude

Attitude describes the farmers' tendency to respond to the acquired technology, whether they accepted, were hesitant, or rejected it. The details of the attitudes of corn farmers can be seen in Table 2. Before the training, the average attitude score of the farmers was 0.357, which fell into the hesitant category. However, after participating in the training and counseling, there was a significant change in attitude, with the score increasing to 0.994. This indicated that the farmers shifted from a hesitant attitude to a very accepting one, with an increase of 63.7 percent.

Based on the analysis results (Table 2), the attitudes of corn farmers toward processing corn cob waste into organic fertilizer before the counseling and training tended to be hesitant, as indicated by the average score of 0.357. This could have been due to their ignorance about the benefits and methods of waste processing. Research by Lubis et al.[16] showed that low farmer knowledge was often a major barrier to adopting environmentally friendly technologies. Hamzah et al. also found that minimal education related to waste processing technologies impacted farmers' motivation to implement new methods.[17] However, after receiving counseling and training, there was an

[16] Irhamna Mandili Lubis et al., "Peran Agroteknologi dalam Mendorong Pertanian Inovatif Berkelanjutan di Kabupaten Labuhanbatu," *JISOSEPOL: Jurnal Ilmu Sosial Ekonomi dan Politik* 2, no. 2 (2024): 140–146.

[17] Hamzah et al., "Diseminasi Teknologi Pengelolaan Limbah Pertanian Menjadi Pupuk Bernilai Ekonomi Tinggi dalam Upaya Mendukung Kesejahteraan Petani," *Jurnal Dedikasi Masyarakat* 2, no. 2 (2019): 83.

improvement in farmers' attitudes, with an average score of 0.994, placing them in the very accepting category. Research by Ellyta et al. proved that agricultural counseling significantly enhanced farmers' understanding and skills in applying new technologies.[18] Sanjaya et al. (2023) and Bahua (2021) also affirmed that farmers' attitudes tended to change positively after receiving adequate information and training.[19]

[18] Ellyta et al., "Aspek Pengetahuan, Sikap dan Keterampilan pada Respon Petani terhadap UPJA di Kecamatan Toho," *Jurnal Social Economic of Agriculture* 8, no. 2 (2019): 13.

[19] Purba Sanjaya et al., "Peningkatan Pengetahuan dan Keterampilan Petani dalam Proses Pembuatan Pupuk Organik di Desa Margomulyo Kecamatan Tegineneng Kabupaten Pesawaran," *Jurnal Pengabdian Fakultas Pertanian Universitas Lampung* 2, no. 1 (2023): 183–190.; Mohamad Ikbal Bahua, "Efektivitas dan Persepsi Pelaksanaan Penyuluhan Pertanian pada Masa Pandemi Covid-19," *Agrimor: Jurnal Agribisnis Lahan Kering* 6, no. 3 (2021): 138–144.

Table 2. The attitude of Corn Farmers in Processing Corn Cob Waste Into Fertilizer

No.	Attitude Indicator	Score			
		Before	Category	After	Category
1.	Processing corn cob waste to protect the environment	0.21	Unsure	1.00	Very Accepting
2.	Training on processing corn cob waste	0.41	Unsure	0.99	Very Accepting
3.	Organic fertilizer improves soil fertility	0.44	Not Accepting	0.99	Very Accepting
4.	Trying to process corn cob waste independently	0.41	Unsure	1.00	Very Accepting
5.	Using technology for waste processing	0.44	Unsure	0.99	Very Accepting
6.	Need for sustainable processing	0.40	Accepting	1.00	Very Accepting
7.	Processing waste to increase income	0.21	Very Not Accepting	0.99	Very Accepting
8.	Collaboration with other farmers	0.40	Unsure	0.99	Very Accepting
9.	Quality of fertilizer from corn cob waste	0.21	Not Accepting	0.99	Very Accepting
10.	Need for ongoing education	0.44	Accepting	1.00	Very Accepting
Average			0.357	Unsure	0.994

The analysis found that farmers accepted that processing corn cob waste could protect the environment. The increased understanding of the positive impacts of this waste processing led farmers to begin recognizing the importance of environmental preservation through the reduction of chemical fertilizer use. Several studies related to waste processing into organic fertilizer, such as Delgano et al., which examined the utilization of organic waste;[20] Kurniawan et al., (2024), who researched liquid tofu waste; Marlina et al., (2021), who utilized dry leaf litter; as well as research by Sari et al., (2024) and Li & Choi, (2022) on the utilization of corn cob waste, supported the notion that processing waste into organic fertilizer has positive effects on the environment and soil

[20] Marina Fernandez Delgano et al., "Liquid Fertilizer Production from Organic Waste by Conventional and Microwave-assisted Extraction Technologies: Techno-economic and Environmental Assessment," *Science of The Total Environment* 806, no. 1 (2022): 150904.

fertility.[21] Marwantika (2020) also found that reducing chemical fertilizers could prevent soil damage caused by the accumulation of chemicals.[22]

The research findings regarding readiness to participate in training indicated the farmers' openness to learning and developing new skills. A study by Sudarwati and Fahira showed that practical training was more effective in motivating farmers to adopt new technologies compared to mere theoretical delivery.[23] Malindir & Mashud also found that the active involvement of farmers in training significantly improved their technical skills.[24]

Regarding the benefits of organic fertilizers for soil fertility, the analysis findings illustrated the farmers' understanding of the advantages that could be gained. Organic fertilizers were proven to successfully improve the physical, chemical, and biological characteristics of the soil, particularly in enhancing humus content and promoting the development of soil organisms, according to Singh et al.,[25] By increasing humus content, there were changes in the biological properties of the soil that helped the growth of beneficial macro and microorganisms. Organic amendments increase soil carbon and nitrogen content, resulting in enhanced soil fertility and crop productivity while also being environmentally friendly and cost-effective.[26] Assefa & Taddese, (2019) found that organic fertilizers helped improve soil structure and retain more water, validating these findings.[27] Liu et al. (2025) also emphasized that organic fertilizers could replace some of the chemical fertilizers used, making them more environmentally friendly.[28] Li et al.

[21] Lutfi Kurniawan, Maryudi Maryudi, and Erna Astuti, "Utilization of Tofu Liquid Waste as Liquid Organic Fertilizer Using the Fermentation Method with Activator Effective Microorganisms 4 (EM-4): A Review," *EJChE: Equilibrium Journal of Chemical Engineering* 8, no. 1 (2024): 100–112.; Neni Marlina et al., "Utilization of Dried Leaf Litter as Organic Fertilizer in Talang Ilir Hamlet, Sukamoro Village, Banyuasin Regency, South Sumatra," *Altifani Journal: International Journal of Community Engagement* 1, no. 2 (2021): 1–10.; Sri Adelila Sari et al., "Pemberdayaan Petani Jagung dalam Mengolah Limbah Tongkol Jagung Empowerment of Corn Farmers in Processing Corn Cob Waste," *Pengabdian Untuk Mu negeRI* 8, no. 2 (2024): 210–293.; Ji Yong Choi and Jihee Nam, "Utilization of Corn Cob, an Essential Agricultural Residue Difficult to Disposal: Composite Board Manufactured Improved Thermal Performance Using Microencapsulated PCM," *Industrial Crops and Product* 183 (2022): 114931.

[22] Asna Istya Marwantika, "Pembuatan Pupuk Organik sebagai Upaya Pengurangan Ketergantungan Petani terhadap Pupuk Kimia di Dusun Sidowayah, Desa Candimulyo, Kecamatan Dolopo, Kabupaten Madiun," *InEJ: Indonesian Engagement Journal* 1, no. 1 (2020): 17–28.

[23] Lina Sudarwati and Nasution Nabila Fahira, "Upaya Pemerintah dan Teknologi Pertanian dalam Meningkatkan Pembangunan dan Kesejahteraan Petani di Indonesia," *Jurnal Kajian Agraria dan Kedaulatan Pangan (JKAKP)* 3, no. 1 (2024): 1–8.

[24] Malindir, Gaston Otto, and Aldi Budi Mashud. "Pemberdayaan Kelompok Tani dalam Meningkatkan Hasil Pertanian di Desa Arjasari Kecamatan Leuwisari Kabupaten Tasikmalaya." Jurnal Politik Pemerintahan Dharma Praja 15, no. 2 (2022): 39-55.

[25] Teg Bahdur Singh et al., "Role of Organic Fertilizers in Improving Soil Fertility," in *Contaminants in Agriculture*, ed. Springer, Cham (2020): 61–77.

[26] Xiangyang Shu et al., "Organic Amendments Enhance Soil Microbial Diversity, Microbial Functionality and Crop Yields: A Meta-analysis," *Science of The Total Environment* 829 (2022): 154627.

[27] Sisay Assefa and Sisay Taddese, "The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity: A Review," *Agricultural Research and Technology* 22, no. 1 (2019): 556192.

[28] Boheng Liu et al., "Partially Replacing Chemical Fertilizer with Manure Improves Soil Quality and Ecosystem Multifunctionality in a Tea Plantation," *Agriculture, Ecosystems & Environment* 378 (2025): 109284.

(2024) stated that the application of organic fertilizers as organic amendments to the soil had historically been practiced by farmers worldwide to improve soil quality, which in turn enhanced crop productivity.[29]

In addition, the findings of the analysis revealed that farmers demonstrated their intention to apply new knowledge by attempting to process corn cob waste. Research indicated that the active involvement of farmers, as stated by Rizzo et al., (2024), was crucial for the success of innovations. Regarding the use of appropriate technology (TTG), it also received positive feedback.[30] This aligns with the findings of Destryana & Pramasari, that TTG increased efficiency and reduced operational costs.[31]

Sustainable waste management emphasizes the importance of long-term commitment. Research by Agustina and Ilalfiah indicated that sustainable practices preserve ecosystems and enhance productivity.[32] Additionally, farmers began to see an increase in income (as noted in question seven) thanks to the use of organic fertilizers.[33] Engagement in collaboration (as mentioned in question eight) strengthened the local agricultural community, supported by the research of Susanto et al.,[34] Farmers also experienced an improvement in the quality of organic fertilizers (as mentioned in question nine) after they observed tangible results, which were in line with the findings of Prasetyo & Evizal.[35]

Furthermore, farmers considered continuous education important. Ongoing education helped farmers adapt to the latest technologies and boosted productivity. Overall, these changes in attitude demonstrated that extension services could transform farmers' behaviors and attitudes toward sustainable agriculture, as noted by Syahrir et al..[36]

[29] Yonghua Li et al., "Enhancing Crop Productivity and Resilience by Promoting Soil Organic Carbon and Moisture in Wheat and Maize Rotation," *Agriculture, Ecosystems & Environment* 368 (2024): 109021.

[30] Giuseppina Rizzo et al., "Key Factors Influencing Farmers' Adoption of Sustainable Innovations: A Systematic Literature Review and Research Agenda," *Organic Agriculture* 14 (2024): 57–84.

[31] R. Amilia Destryana and Ika Fatmawati Pramasari, "Peningkatan Produktivitas Lengkuas Melalui Teknologi Tepat Guna Bagi Kelompok Tani Amanah di Desa Matanair Jawa Timur," *JMM (Jurnal Masyarakat Mandiri)* 5, no. 1 (2021): 24–33.

[32] Isna Fitria Agustina and Luluk Ilalfiah, "Sustainable Organic Waste Management for Village SDGs Pengelolaan Sampah Organik Berkelanjutan untuk SDGs Desa," *Indonesian Journal of Public Policy Review* 24 (2023).

[33] Sekar Putri Mahardika, "Metode Efektif Pembuatan Pupuk AHA (Aplikatif, Hemat, dan Anti Polusi) dalam Meningkatkan Kualitas Hasil Pertanian," *Jurnal Teknik Lingkungan* 29, no. 2 (2023): 1–5.

[34] Hendrik Susanto, Lavenia Lauwinata, and Simon Ebel Maris Phoek, "Strategi Ekonomi Hijau untuk Pertanian: Studi Komparatif Variabel, Metodologi, dan Perangkat Lunak," *Journal of Law, Administration, and Social Science* 4, no. 5 (2024): 947–961.

[35] Dedy Prasetyo and Rusdi Evrizal, "Pembuatan dan Upaya Peningkatan Kualitas Pupuk Organik Cair," *Jurnal Agrotropika* 20, no. 2 (2021): 68–80.

[36] Muhammad Syahrir, H. Muharram, and Sulfikar, "Pelatihan dan Pemberdayaan Masyarakat Petani dalam Pembuatan Pupuk Organik dari Limbah Tongkol Jagung di Kelurahan Canrego Kec. Polsel Kabupaten Takalar," *Seminar Nasional Hasil Pengabdian 2021* (2021)

Skills

The ability of corn farmers to convert their corn cob waste into organic fertilizer is an important indicator to evaluate. This skill demonstrates the extent to which farmers can master the necessary processes and techniques. Based on the data presented in Table 3, the farmers' skills showed a significant improvement after the extension and training were conducted.

Table 3. Assessment of the Skills Aspects of Corn Farmers

No.	Skills Indicator	Score			
		Before	Category	After	Category
1.	Processing corn cob waste into organic fertilizer	0.21	Not Skilled	1.00	Very Skilled
2.	Using appropriate technology (TTG)	0.21	Not Skilled	1.00	Very Skilled
3.	Mixing corn cob waste with other materials	0.21	Not Skilled	1.00	Very Skilled
4.	Managing the fermentation process of organic fertilizer	0.21	Not Skilled	0.95	Very Skilled
5.	Monitoring temperature and humidity during the production process	0.21	Not Skilled	0.99	Very Skilled
6.	Stirring the organic fertilizer mixture evenly	0.21	Not Skilled	1.00	Very Skilled
7.	Packaging organic fertilizer after the production process is completed	0.21	Not Skilled	1.00	Very Skilled
8.	Storing organic fertilizer from corn cob waste	0.21	Not Skilled	1.00	Very Skilled
9.	Using processed organic fertilizer on agricultural land	0.40	Not Skilled	1.00	Very Skilled
10.	Applying new techniques in the production of organic fertilizer	0.20	Not Skilled	0.99	Very Skilled
	Average	0.222	Not Skilled	0.993	Very Skilled

Before the counseling and training activities were conducted, the corn farmers' skills had an average score of 0.222, indicating a lack of skills. After participating in the counseling and training, the score increased to 0.993, which falls into the very skilled category. This improvement represents a skill increase of 77.1 percent. This reflects the effectiveness of the counseling and training program provided in enhancing farmers' abilities to process corn cob waste into organic fertilizer. Table 3 presents the evaluation of the attitude characteristics of corn producers.

Table 3 showed that one of the most critical factors in maintaining environmental sustainability and improving agricultural yields was the farmers' ability to transform

corn cob waste into organic fertilizer. This process began with mastering basic skills, such as the proper sorting of corn cob waste. This waste was abundant and easily accessible to farmers, making the skill to process it into organic fertilizer crucial. Farmers skilled in the initial stages of waste processing could produce higher-quality fertilizer, thus supporting the success of sustainable agricultural practices. Malika et al. confirmed that training in processing corn cob waste improved farmers' skills in utilizing natural materials for organic fertilizer, thereby reducing the use of chemical fertilizers.[37]

Furthermore, the skills in using appropriate technology (TTG), such as waste shredding tools, played a crucial role in enhancing processing efficiency. Farmers were able to produce organic fertilizer in a relatively short time and larger quantities by accelerating the processing stages and minimizing manual labor. This also impacted their economic conditions and scale of production. According to research by Sari et al., (2024), processing organic fertilizer with the right technology could lower production costs while simultaneously increasing crop yields.[38]

The mixing of materials and fermentation processes were critical stages that determined the quality of organic fertilizer. Skills in blending corn cob waste with other materials, as well as controlling temperature and humidity during fermentation, were essential to ensure that the produced fertilizer was nutrient-rich. Proper mixing techniques significantly influenced the quality of the resulting fertilizer.[39] Therefore, for farmers to produce the best fertilizer, they needed to master these techniques. Likewise, the ability to manage the fermentation process of organic fertilizer,[40] It was crucial for the success of fertilizer production. Additionally, effective fermentation enhanced the nutrient content of the fertilizer, ultimately impacting soil fertility and farmers' crop yields. Previous research by Amalia et al., (2020) Provided evidence that properly fermented organic fertilizer could increase soil potassium, phosphorus, and nitrogen levels.[41] This underscored the importance of skills in the fermentation stage as a determining factor for the successful processing of organic fertilizer. After the production process was completed, skills in packaging (Figure 6), storing, and applying organic fertilizer became the next essential steps.

[37] Uyun Erma Malika et al., "Peningkatan Keterampilan Petani dalam Memproduksi Pupuk Organik di Desa Tutul Kecamatan Balung Kabupaten Jember," *NaCosVi: Polije Proceedings Series* 6, no. 1 (2024): 451–454.

[38] Sri Adelila Sari et al., "Pemberdayaan Petani Jagung dalam Mengolah Limbah Tongkol Jagung Empowerment of Corn Farmers in Processing Corn Cob Waste," *Pengabdian Untuk Mu negeRI* 8, no. 2 (2024): 210–293.

[39] Dewi Widyabudiningsih et al., "Pembuatan dan Pengujian Pupuk Organik Cair dari Limbah Kulit Buah-buahan dengan Penambahan Bioaktivator EM4 dan Variasi Waktu Fermentasi," *Indonesian Journal of Chemical Analysis (IJCA)* 4, no. 1 (2021): 30–39.

[40] Yusuf Sutaryono and S. Mutia, "Inovasi Teknologi Pembuatan Pupuk Organik Cair Berbasis Limbah Sabut Kelapa," *Jurnal Pengabdian Magister Pendidikan IPA* 5, no. 2 (2022): 204–208.

[41] Lia Amalia et al., "Fermented Compost and N-Fertilizer for Enhancing the Growth and Productivity of Purple Eggplant on Vertisols," *Open Agriculture* 5, no. 1 (2020): 898–904.

(a) (b)

Figure 6. Organic Fertilizer Packaging Activities: (a) The Process of Filling Fertilizer into Packaging and (b) Packaged Fertilizer

Farmers who were skilled in properly storing organic fertilizer could maintain its quality for a more extended period. Similarly, skills in applying fertilizer to agricultural land, where the correct dosage and timing could maximize nutrient absorption by the soil and crops, proved to enhance land productivity significantly. Research by Mahbub et al. found that the use of organic fertilizer with proper application techniques improved crop yields compared to traditional methods.[42] Adaptation to new techniques in organic fertilizer production demonstrated farmers' openness to more efficient and environmentally friendly innovations. Farmers who were skilled in implementing these innovations could enhance both the quality and quantity of the produced organic fertilizer while reducing processing time. With appropriate training and counseling, these skills could continue to develop, encouraging farmers to participate in more sustainable and productive agricultural practices. This aligned with findings that farmers who participated in technological innovation training for processing corn cob waste were able to enhance their technical skills and produce higher-quality fertilizer.

Achievement of the SDGs

The analysis of the attitudes and skills of farmers involved in the production of organic fertilizer from corn cobs showed an increase in awareness of the importance of sustainable agriculture. Most farmers acknowledged that producing organic fertilizer could enhance soil quality and reduce the use of chemical fertilizers. However, there were still obstacles, such as limited knowledge about proper organic fertilizer production techniques, lack of access to information, and limited time available to farmers. Additionally, more significant efforts were needed to improve farmers' skills in effectively managing agricultural waste.

The practice of producing organic fertilizer from corn cobs had a positive impact on the achievement of several Sustainable Development Goals (SDGs). First, this activity

[42] Itang Ahmad Mahbub et al., "Peningkatan Kesuburan Tanah dan Hasil Padi Sawah Melalui Aplikasi Pupuk Organik," *Jurnal Tanah dan Sumberdaya Lahan* 10, no. 2 (2023): 335–340.

supported SDG 2 (ending hunger) through the quality and production of crops in agriculture. Organic fertilizers, rich in natural materials, could strengthen soil texture and increase its capacity to retain water and supply nutrients for plants. Second, this practice contributed to SDG 15 (protecting, restoring, and promoting the sustainable use of terrestrial ecosystems) by reducing land degradation and improving soil ecosystem health. Third, the production of organic fertilizer could contribute to poverty alleviation (SDG 1) by increasing farmers' incomes through improved productivity and quality of harvests. Lastly, this practice could stimulate local economic growth (SDG 8) through the development of the organic fertilizer industry and increased added value of agricultural products (Sustainable Development Goals SDGs 2017).

The results of this study indicated that training and empowering farmers to produce organic fertilizer was an essential step in achieving the SDGs at the local level. However, more comprehensive efforts were needed to address the challenges faced by farmers, such as providing easier access to information and technology and supportive policies for the development of sustainable agriculture. Furthermore, further research was needed to assess the long-term impact of organic fertilizer use on farmers' welfare, environmental quality, and agricultural outcomes.

Conclusion

After the analysis was conducted, it was concluded that the training on organic fertilizer production from corn stover successfully improved farmers' attitudes and skills in adopting sustainable agricultural practices. Farmers increasingly recognized the importance of maintaining soil and environmental quality through the use of organic fertilizers. The implementation of this practice not only contributed to the increase in agricultural productivity but also supported the realization of several Sustainable Development Goals (SDGs), particularly SDGs 2, 15, 1, and 8. Nevertheless, further efforts were still needed to expand the reach of the training, enhance farmers' access to information and technology, and create policies that support the development of organic agriculture.

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