Journal of Tropical Mycorrhiza
https://journal.ami-ri.org/index.php/JTM
E-ISSN 2829-467X
Vol. 3 No. 2 October 2024

Effectiveness of Kirinyuh Weed LOF , AMF and Local Corn Production on Marginal Land in Southeast Sulawesi

Andi Nurmas[1], Robiatul Adawiyah[2*)], Rachmawati Hasid[3]
[1,2,3)] Program Studi Agroteknologi Fakultas Pertanian UHO Kendari, Indonesia
*Corresponding author : *robiatul1@gmail.com*

ABSTRACT. This research aims to determine the effectiveness of kirinyuh weed LOFand AMF on local corn production on marginal land in Southeast Sulawesi. Research was carried out in the Experimental Garden Field Lab II and Lab. Agronomy Unit, Faculty of Agriculture, UHO, Kendari, from May-October 2022. The research used a Randomized Block Design (RBD) with a factorial pattern consisting of two factors. The first factor is liquid organic fertilizer (LOF) which consists of 4 levels, namely without LOF (P0), LOF 20 mL L-1 water (P1), LOF25 mL L-1 water (P2), LOF 30 mL L-1 water (P3). The second factor is FMA which consists of 3 levels, namely without AMF (M0), FMA 15 g/ planting hole (M1), and FMA 20 g/planting hole (M2). The variables observed were plant height, number of leaves, stem diameter, ear length, number of rows per ear, ear diameter, weight of 100 seeds and productivity. The research results showed that there was no interaction effect of LOF and AMF treatment on plant height and productivity but had a significant effect on the number of leaves, stem diameter, ear length, number of rows per ear, weight of 100 seeds and productivity. The LOF treatment of LOF 30 mL L-1 water and AMF 15 g/plant is the best treatment for local corn production on marginal land.

Keywords : *AMF, LOF, and corn production*

INTRODUCTION

The productivity of corn crops in Southeast Sulawesi is still relatively low because most of it is cultivated on marginal land. The growth and development of corn cannot be separated from the availability of nutrients that plants use to ensure optimal growth and production. Fertile soil containing sufficient and balanced amounts of macro and micro nutrients will influence plant growth and production (Nurmas et al., 2023). Current soil conditions do not support the growth and production of corn plants because the continuous use of inorganic fertilizers such as NPK has a negative impact on the soil resulting in decreased organic matter levels, soil compaction, environmental pollution and decreased activity of soil microorganisms. One of the efforts made to overcome these problems and obstacles is the use of liquid organic fertilizer (LOF) and arbuscular mycorrhizal biofertilizer (AMF). Liquid organic fertilizer is a solution that comes from the decomposition of organic materials originating from plant residues, weeds, animal waste which contains more than one nutrient element and has been decomposed so that it is easily absorbed by plants, does not damage the soil and plants (Hadisuwito, 2012 ; Duaja, 2012).

Mycorrhizal fungi are the result of a mutualistic symbiosis between fungi/fungi (Myces) and the root system of higher plants (rhizae). According to Sukiman (2015), the presence of mycorrhiza in the plant root system can help absorb macro and micro nutrients, especially phosphate and produce growth regulators to stimulate plant growth. Mycorrhizal fungi play a role in maintaining ecosystem stability, biodiversity and improving soil structure. Apart from that, mycorrhiza can also be used as a bioindicator to determine environmental quality. As Fan et al. (2024) reported that AMF application significantly affected root development, availability of nitrogen, phosphorus, potassium and crop yields compared to without AMF treatment.

Arbuscular mycorrhizal fungi (AMF) are fungi that live in mutualistic symbiosis with 97% of higher plants (Musfal, 2010). AMF acts as a biological fertilizer which provides various benefits for host plants, including increasing the area of water absorption and increasing plant tolerance to element poisoning, extreme temperatures, low pH (Munawar, 2011). AMF hyphae can secrete phosphatase enzymes which can increase the availability of P elements for plants (Musfal, 2008). The presence of AMF can improve the physical properties of the soil (Prihantoro, et al. 2015; Roni et al., 2015) and AMF can increase plant resistance due to pest or disease attacks (Soenartiningsih, 2013; Wahyu et al., 2013). Plants that are in symbiosis with AMF can be seen from the level of AMF infection in plant roots. The role of mycorrhiza as a biofertilizer is very important in the process of restoring and increasing land productivity in a sustainable manner related to nutrient availability and reducing the use of inorganic fertilizers and fossil-based energy materials (Oktafitria et al., 2019).

Arbuscular mycorrhizal fungi (AMF) form symbiotic relationships with the roots of nearly all land-dwelling plants, thereby enhancing growth and productivity, especially during abiotic stress. AMF improves plant development by increasing the acquisition of nutrients, such as uptake of phosphorus, water and minerals. AMF increases plant tolerance and resistance to abiotic stressors such as drought, salt, and heavy metal toxicity. These benefits stem from the arbuscular mycorrhizal interface, which allows fungi and plants to exchange nutrients, signaling molecules, and protective chemical compounds. Plant antioxidant defense systems, osmotic adjustments, and hormone regulation are also affected by AMF infestation.

Based on the Regulation of the Minister of Agriculture of the Republic of Indonesia Number 70/PERMENTAN /SR.140/10/2011 concerning organic fertilizer, biofertilizer and soil conditioner (Ministry of Agriculture, 2010), "biofertilizer or biological fertilizer is an active biological product consisting of microbes that can increase fertilization efficiency , fertility and soil health", so that mycorrhiza is an example of a biofertilizer. Biofertilizer AMF is a biological fertilizer that comes from culturing mycorrhizae that have been isolated from certain locations, followed by extraction and trapping methods for the multiplication of mycorrhizal colonies. Making biofertilizers from indigenous (local) mycorrhiza is one of the efforts that can be made to increase land and plant productivity, such as corn (Zea mays L.).

The results showed that better growth and yield of sweet corn were obtained in the independent treatment of liquid organic fertilizer concentration of 45 mL L-1 water and mycorrhizal biofertilizer dose of 15 g/plant, but there was no interaction between the mycorrhizal biofertilizer dose and the concentration of liquid organic fertilizer on all parameters (Muyasir et al., 2022).

MATERIALS AND METHODS

Location and Time of Research: This research was carried out at the Field Laboratory Experimental Garden II and the Agrotechnology Laboratory, Agronomy Unit, Faculty of Agriculture, Halu Oleo University, Kendari, which took place from May to October 2022.

Materials and Equipment: The materials used in this research were corn seeds (Local Muna), Arbuscular Mycorrhizal Fungi Propagules (AMF) from the roots of reeds, kirinyuh weed, brown sugar, EM4, rice washing water and sterile water. The tools used consisted of a hoe, machete, tape measure, neat rope, jugular, gembor, scissors, pamphlet board, caliper, chopping machine, camera, and stationery.

Research Design: The design used in this research was a factorial pattern randomized block design (RBD) consisting of two factors. The first factor is liquid organic fertilizer (LOF) which consists of 4 levels, namely without LOF(P0), LOF 20 mL L^{-1} water (P1), LOF 25 mL L^{-1} water (P2), LOF 30 mL L^{-1} water (P3). The second factor is arbuscular mycorrhizal fungi (AMF) which consists of 3 levels, namely without AMF (M0), AMF 15 g/planting hole (M1), and AMF 20 g hole/planting (M2). Thus, 12 treatment combinations were obtained, repeated three times to obtain 36 experimental units. Each experimental unit contained 30 plants so the total was 1,080 corn plants.

Preparation of Kirinyuh weed LOF and AMF: Making kirinyuh weed LOF is done by preparing the ingredients, namely kirinyuh weed which has been chopped and weighed according to the required dose, rice washing water, brown sugar and EM4. All ingredients are put into a bucket and then closed tightly. Every 2 days the lid of the bucket is opened briefly to release the gas that forms. LOF is fermented for two weeks. After two weeks the LOF is filtered and the fertilizer is ready to be applied. The AMF inoculum was explored from the roots of alang-alang (*Imperata cylindrica* L.) chunks of soil and roots by digging using a crowbar to a depth of ± 30 cm. The soil is broken with a machete and the chunks of soil are crushed until they are small. Soil and roots containing mycorrhizal fungal inoculum were dried by airing and sieved using a waring net. The AMF propagules obtained were propagated on corn plants in plastic houses (Halim *et al*., 2012; Hasid *et al*. 2018)**.**

Application of LOF for kirinyuh weed and AMF: Application of LOF is carried out twice, firstly when the plants are 7 HST and secondly at 45 HST by spraying all parts of the plant according to the treatment dose. Meanwhile, FMA is given only once according to the treatment dose by inserting it into the planting hole when the corn plants are planted.
Observation Variable: evaluation of local corn growth and production:
(1) Plant height (cm) is measured at 42 DAT
(2) Stem diameter (cm) was measured at 42 DAT
(3) The number of leaves (strands) was measured at 42 DAT
(4) Cob length (cm): Measuring the length of the cobs is carried out after harvest, namely after the cobs are separated from the husks. Measurements are taken from the base to the tip of the cob using a ruler.
(5) Number of rows per cob (row): The number of rows per cob is calculated from the first row to the last row, the calculation of the number of rows is done at harvest.
(6) Weight of 100 seeds: carried out by drying the shelled corn until the moisture content reaches ±14% then weighing using a digital scale.
(7) Productivity (ton ha^{-1}): calculated using the following formula:

$$\text{Productivity} = \frac{\text{Land area per hectare}}{\text{Planting distance}} \times \frac{\text{Weight of seeds per plant}}{1{,}000{,}000}$$

Data Analysis: Data were analyzed using ANOVA and further testing using Duncan's Multiple Range Test (DMRT) with a confidence level of 95%.

RESULTS AND DISCUSSION

Table 1 shows that the interaction of LOF and AMF treatment had a very significant effect on stem diameter, number of leaves, ear length, number of rows per ear, weight of 100 seeds and productivity, but had no significant effect on plant height. LOF treatment had a significant effect on plant height, stem diameter, number of leaves, number of rows per ear, weight of 100 seeds, and plant productivity, but had no significant effect on ear length. AMF treatment had a very significant effect on ear length, number of rows per ear, weight of 100 seeds but had no significant effect on other variables.

Table 1. Recapitulation of variance in effectiveness of LOF of kirinyuh weed, AMF and local corn production on Marginal Land

No.	Observation Variables	P*M	LOF (P)	FMA (M)
1	Plant Height (cm) 42 DAT	ns	**	ns
2	Stem Diameter (cm) 42 DAT	**	*	ns
3	Number of Leaves (Strands) 42 DAT	**	**	ns
4	Cob length (cm)	**	tn	**
5	Number of Rows Per Cob (rows)	**	**	**
6	Weight of 100 Seeds (g)	**	**	**
7	Productivity (ton ha^{-1})	**	**	ns

Description: **= very significant effect, *= significant effect, ns = not significant effect

Plant Height

Table 2. Effectiveness of LOF treatment of kirinyuh weed on the average height of local corn plants aged 42 DAT on marginal dry land

Treatment	Observation Time 42 DAT	$DMRT_{\alpha=0,05}$
Without LOF (P0)	57,39d	
LOF 10 mL L^{-1} water (P1)	57,26c	2 =0,14
LOF 20 mL L^{-1} water (P2)	57,81b	3 =0,14
LOF 30 mL L^{-1} water (P3)	57,83a	4 =0,15

Description : Numbers followed by letters that are not the same are declared significantly different based on DMRTα = 0.05.

Table 2 shows that the highest plants were obtained in the LOF 30 mL L^{-1} water treatment (P3) which was significantly different from the other treatments, while the lowest plants were obtained in the treatment without LOF (P0). This fact is thought to be because the higher the dose of LOF applied, the more nutrients are available to corn plants. The effect of liquid organic fertilizer on plant productivity depends on various parameters, the source of the LOF, concentration and type of plant. Moringa LOF 20 mL L^{-1} water has a significant effect on plant height, number of leaves and number of tillers in highland red rice (Nasira *et al*., 2021). Puteri *et al*. (2021) reported that *Tithonia* LOF had no effect on sweet corn plant height. This is in line with the research results of Anastasia *et al*. (2015) that with each increase in the dose of liquid organic fertilizer, the height of the mustard greens increases. Hadisuwito (2012) reported that the more N nutrients available from liquid water hyacinth organic fertilizer, the activity of microorganisms increases, causing an increase in the height of mustard plants. Ridwan *et al*. (2020) reported that plant height, number of leaves, and duration of flowering of soybean plants were higher in the treatment of LOF with 15 mL L^{-1} water compared to the control.

Kirinyuh LOF contains nitrogen nutrients which function for growth and development, especially in the vegetative phase of plants. Nitrogen plays an important role in the formation of chlorophyll which is useful in photosynthesis. The photosynthesis process functions to obtain nutrients and energy for plants, sufficient chlorophyll content can stimulate plant growth, especially stimulating plant vegetative organs (Nurmas *et al*. 2023). Application of LOF of gamal leaves and banana weevils can increase rice production compared to LOF of gamal leaves or banana weevils alone (Mollah *et al*., 2021). According

Journal of Tropical Mycorrhiza
https://journal.ami-ri.org/index.php/JTM
E-ISSN 2829-467X
Vol. 3 No. 2 October 2024

to Tsaniya *et al*. (2021) that the combination of LOF *Gracilaria* sp. and *Sargassum* sp. contains C-Organic levels of 1.15%, nitrogen 0.67%, phosphorus 0.45% and potassium 0.48%.

Kasim *et al*. (2019) reported that administering LOF at a concentration of 10 mL L^{-1} water increased passion fruit growth. Therefore, the effect of LOF depends on the source of the material, concentration, type of plant and environmental factors. The results of research by Nurmas *et al*. (2021) showed that kirinyuh leaves have potential as a LOF as indicated by an increase in the number of tillers, wet weight and dry weight of celery plants. A dose of 80 mL L^{-1} water is the best treatment to increase the growth and production of celery plants.

Stem Diameter

Table 3. Interaction of LOF and AMF treatment on marginal land on the average stem diameter (cm) of local corn plants aged 42 DAT

LOF Kirinyuh (mL L^{-1} water)	FMA (g/planting hole)			$DMRT_{\alpha=0,05}$
	M0	M1	M2	
Without LOF (P0)	0,76c	0,93b	1,02a	
	r	Q	q	
LOF 20 mL L^{-1} water (P1)	1,36a	0,83c	0,99b	2 =0,061
	p	R	q	
LOF 25 mL L^{-1} water (P2)	1,11b	1,18a	0,83c	3 =0,064
	p	P	r	
LOF 30 mL L^{-1} water (P3)	1,02b	1,18a	1,40a	4 =0,066
	q	P	p	
$DMRT_{\alpha=0,05}$		2 =0,05	3 =0,05	

Description: Numbers followed by letters that are not the same in the same column (p, q, r) and the same row (a, b, c) are significantly different based on $DMRT_{\alpha=0,05}$

Table 3 shows that the largest stem diameter obtained from the interaction of LOF 30 mL L^{-1} water and AMF 20 g/planting hole (P3M2) was not significantly different from the treatment LOF 20 mL L^{-1} water and without AMF (P1M0), LOF 25 mL L^{-1} water and 15 g AMF/planting hole (P2M1), and LOF 30 mL L^{-1} water and 15 g AMF/planting hole (P3M1). The smallest stem diameter was obtained in the treatment without LOF and AMF (P0M0) and LOF 25 mL L^{-1} water and AMF 20 g/planting hole (P2M2). This is thought to be because LOF is able to provide the nutrients needed by corn plants and AMF which contains growth hormones is able to accelerate the vegetative growth of corn plants including stem diameter. Mycorrhizal infection in the roots causes plants to have the ability to grow quickly. This proves that mycorrhizae are able to expand the absorption area of plant roots so that nutrient absorption is more optimal which influences the plant growth process (Hairiah, 2010). According to Hartanti (2014), increasing stem diameter is influenced by the availability of nutrients in the soil, especially phosphorus (P), which plays a role in the division and development of plant cells. Providing AMF as a biofertilizer can increase the absorption of phosphorus (P) by plants. In this case, phosphorus is involved in the division and formation of plant root and stem cells. Mycorrhiza produces the hormone auxin which functions to stimulate plant cell elongation and the enzyme phosphatase which helps the process of absorbing the nutrient P. Nutrient absorption is carried out by the external hyphae of the mycorrhiza which extend into the soil, which is then used to stimulate the photosynthesis process. The results of photosynthesis will be distributed to all parts of the plant for plant growth and development.

Number of Leaves

Table 4. Interaction of LOF treatment of kirinyuh weed and AMF on marginal land on the average number of leaves at 42 DAT

LOF Kirinyuh ($mL\ L^{-1}$ water)	FMA(g/planting hole)			
	M0	M1	M2	$DMRT_{\alpha=0,05}$
Without LOF (P0)	5,00b p	6,00a q	6,00a q	
LOF 20 $mL\ L^{-1}$ water (P1)	6,00a q	5,00b P	6,00a q	2 =0,098
LOF 25 $mL\ L^{-1}$ water (P2)	6,00a q	6,00a q	5,00b p	3 =0,103
LOF 30 $mL\ L^{-1}$ water (P3)	6,00b q	6,00b q	6,33a r	4 =0,106
$DMRT_{\alpha=0,05}$		2 =0,07	3 =0,08	

Description: Numbers followed by letters that are not the same in the same column (p, q, r) and the same row (a, b) are significantly different based on $DMRT_{\alpha=0,05}$

Table 4 shows that the highest number of leaves obtained in the interaction of LOF 30 mL L^{-1} water and AMF 20 g/planting hole (P3M2) was significantly different from the other treatments. The lowest number of leaves was obtained in the treatment without FOF and AMF (P0M0), LOF 20 mL L^{-1} water and AMF 15 g/planting hole (P1M1), and LOF 25 mL L^{-1} water and AMF 20 g/planting hole (P2M2).

Providing LOF and AMF is very good for supporting plant growth because growth is very dependent on the availability of N and P to delay leaf fall and maintain photosynthesis during plant growth (Nasaruddin, 2012). Apart from that, increasing plant growth is also influenced by the physical properties of the soil. Providing LOF and AMF inoculation can improve the physical properties of the soil in the form of reducing soil bulk weight, increasing soil porosity and increasing soil permeability. Reducing the bulk weight of the soil causes plant root development to proceed well, which will affect the absorption of water and nutrients needed by plants from the vegetative to the generative phase. An increase in soil permeability increases water entering the soil which will be used by plants to carry out their growth (Hidayat *et al*., 2019). AMF plays an important role in the availability of nutrients such as P, Mg, K, Fe and Mn for plant growth (Talanca, 2010). AMF can produce the hormones auxin, cytokinin, gibberellin and vitamins in its host plants. This occurs through the formation of hyphae on the root surface which functions as an extension of the roots, especially in areas where conditions are poor in nutrients, low pH and lack of water (Rivana *et al*., 2016).

Cob Length

Table 5 shows that the longest cob obtained in the interaction of LOF 30 mL L^{-1} water and AMF 15 g /planting hole (P3M1) was significantly different from the other treatments. The shortest cob length obtained in the treatment without LOF and AMF (P0M0) was significantly different from the treatment with LOF 30 mL L^{-1} water and without AMF (P3M0), LOF 20 mL L^{-1} water and AMF 15 g/planting hole (P1M1), and LOF 30 mL L^{-1} water and AMF 20 g/planting hole (P3M2). This shows that the application of liquid organic fertilizer with arbuscular mycorrhizal fungi has an influence on ear length.

Table 5. Effect of interaction between liquid organic fertilizer from kirinyuh weed and arbuscular mycorrhizal fungi on cob length on marginal land.

LOF Kirinyuh ($mL\ L^{-1}$ water)	FMA (g /planting hole)			
	M0 (0g)	M1 (15g)	M2 (20g)	$DMRT_{\alpha=0,05}$
Without LOF (P0)	13,16b p	13,73b q	13,42b q	
LOF 20 mL L^{-1} water (P1)	13,68b p	14,89b p	13,67b q	2=0,78
LOF 25 mL L^{-1} water (P2)	13,74b p	13,23c q	13,47b q	3=0,82
LOF 30 mL L^{-1} water (P3)	15,58a q	16,78a r	16,30a p	4=0,85
$DMRT_{\alpha=0,05}$		2 =0,68	3 =0,71	

Description: Numbers followed by letters that are not the same in the same column (p, q, r) and the same row (a, b, c) are significantly different based on $DMRT_{\alpha=0,05}$

Liquid organic fertilizer has several benefits, including stimulating the growth of production branches, increasing the formation of flowers and fruit ovaries, and reducing the fall of leaves, flowers and fruit ovaries (Huda, 2013). On the other hand, AMF can produce the hormone auxin, cytokinin, gibberellin and vitamins in its host plant. The hormone auxin plays a role in growth to stimulate the process of cell elongation and the hormone cytokinin plays a role in cell division, so that the cobs are longer in balanced LOF and AMF treatment.

Number of Rows Per Cob

Table 6. Effect of interaction between liquid organic fertilizer from kirinyuh weed and arbuscular mycorrhizal fungi on the number of rows per cob on marginal land.

LOF Kirinyuh ($mL\ L^{-1}$ water)	FMA (g/planting hole)			
	M0 (0g)	M1 (15g)	M2 (20g)	$DMRT_{\alpha=0,05}$
Without LOF (P0)	19,00b q	19,67b q	21,00b q	
LOF 20 mL L^{-1} water (P1)	21,33b q	18,33b q	19,67b q	2=3,69
LOF 25 mL L^{-1} water (P2)	21,00b q	21,33b q	23,00b q	3=3,88
LOF 30 mL L^{-1} water (P3)	17,00b q	25,00a p	23,00b q	4=3,99
$DMRT_{\alpha=0,05}$		2 =3,20	3 =3,66	

Description: Numbers followed by letters that are not the same in the same column (p, q) and the same row (a, b) are significantly different based on $DMRT_{\alpha=0,05}$

Table 6 shows that the highest number of rows obtained in the interaction of LOF 30 mL L^{-1} water and AMF 15 g/planting hole (P3M1) was significantly different from the other treatments. The lowest number of rows obtained in the treatment without LOF and AMF (P0M0) was only significantly different from the treatment with LOF 30 mL L^{-1} water and AMF 15 g/planting hole (P3M1), while the other treatments were not significantly different. Similar to cob length, the highest number of rows was obtained in the P3M1 treatment interaction. This shows that the application of LOF and AMF has an influence on the number of rows per corn cob. The increase in the number of ear rows and ear length is positively correlated because most traits are genotypically closely related to plant yield (Amare *et al*., 2015).

Weight of 100 Seeds

Table 7. Effect of interaction between liquid organic fertilizer from kirinyuh weed and arbuscular mycorrhizal fungi on the weight of 100 seeds on marginal land.

LOF Kirinyuh (mL L^{-1} water)	FMA (g/planting hole)			
	M0 (0g)	M1 (15g)	M2 (20g)	$DMRT_{\alpha=0,05}$
Without LOF (P0)	13,42c r	20,26b q	26,61a p	
LOF 20 mL L^{-1} water (P1)	18,14b q	21,84b q	27,22a p	2=3,88
LOF 25 mL L^{-1} water (P2)	18,42b q	17,44b q	22,14a q	3=4,08
LOF 30 mL L^{-1} water (P3)	20,54a q	22,20a pq	22,94b q	4=4,20
$DMRT_{\alpha=0,05}$		2 =2,24	3 =2,36	

Description: Numbers followed by letters that are not the same in the same column (p, q, r) and the same row (a, b, c) are significantly different based on $DMRT_{\alpha=0,05}$

Table 7 shows that the weight of the 100 heaviest seeds obtained in the treatment interaction without LOF and AMF 20 g/planting hole (P0M2) was significantly different from the other treatments. The lightest weight of 100 seeds obtained in the treatment without LOF and AMF (P0M0) was significantly different from the other treatments. This shows that the application of arbuscular mycorrhizal fungi has an influence on the weight of 100 corn kernels. If the availability of nutrients needed by plants is sufficient, metabolism will run quickly, where the results of this metabolism will also occur in seed formation, so that meeting nutrient needs will increase the weight of 100 seeds. One way to provide N, P, K nutrients to black soybeans on Ultisols land is by providing weed-based Liquid Organic Fertilizer (LOF) to increase soybean growth and yield. Kirinyuh weed (*Chromolaena odorata*, L) has the potential to be a source of LOF because kirinyuh weed produces high biomass and nutrient content such as N: 0.145%, P: 2.07%, and K: 0.45% (Pujiwati *et al*., 2021) . The research results of Nurmas *et al*. (2023) showed that the application of C. odorata bokashi fertilizer and mycorrhizal fungi had a significant effect on plant height (cm), leaf area index (cm2), RGR ($g.g^{-1}$ day^{-1}), and dry seed production (ton ha^{-1}).

Productivity

Table 8. Independent influence of liquid organic fertilizer treatment of kirinyuh weed or arbuscular mycorrhizal fungus on the productivity of corn plants on marginal land.

LOF Kirinyuh (P)	Productivity (t ha^{-1})		$DMRT_{\alpha=0,05}$
Without LOF (P0)	1,05	b	
LOF 20 mL L^{-1} water (P1)	1,15	ab	2 = 0,36
LOF 25 mL L^{-1} water (P1)	1,23	ab	3 = 0,38
LOF 30 mL L^{-1} water (P1)	1,41	a	4 = 0,39
FMA (M)			
Without FMA (M0)	1,05	b	
FMA 15 g/planting hole (M1)	1,25	a	2 = 0,41
FMA 20 g/planting hole^{-} (M2)	1,32	a	3 = 0,43

Description : Numbers followed by letters that are not the same are declared significantly different based on $DMRT_{\alpha=0,05}$

Table 8 shows that in the LOF treatment, the highest productivity was obtained in the LOF treatment of 30 mL L^{-1} water (P3) which was significantly different from the treatment without LOF, but not significantly different from the other LOF treatments. In the AMF treatment, the highest productivity was obtained in the 20 g AMF/planting hole (M2) treatment, which was not significantly different from the 15 g/planting hole (M1) treatment, but was significantly different from the treatment without AMF. Corn plants provide maximum results if the nutrients are sufficient and available to the plant, because the generative phase requires nutrients that are no different from the vegetative phase. Plant yields will be optimal if the conditions are met, such as the availability of sufficient nutrients and appropriate environmental factors (Ikhwana *et al*., 2015).

The use of kirinyuh leaf LOF helps provide nutrients to increase corn plant production. Murdaningsih and Mbu'u (2014), in their research, explained that the LOF nutrient content of kirinyuh leaves is N 4.10%, P 0.21% and K 0.99%. Increasing corn production is not only about the availability of nutrients but also how these nutrients are absorbed by the plant. Nutrient absorption has an important role in increasing corn production. AMF treatment had a very real effect on increasing corn production. Zuhry and Puspita (2008) stated that an increase in AMF application followed by an increase in root infection will produce intensive hyphae networks thereby increasing the capacity for nutrient absorption. Furthermore, it was also explained that the more infected roots, the greater the level of nutrient absorption, especially in nutrient-poor soil.

Nurmas *et al*. (2017) reported that the combination of manure treatment with the Azotobacter sp biofertilizer resulted in the production of dry seeds of local Konawe fluffier corn of 4.48 tons ha^{-1}. As reported by Nurmas *et al*. (2023) that the combination of bokashi Chromolaena odorata 6 tons ha-1 and arbuscular mycorrhizal fungi 50 g/planting hole was the best treatment with local pulut corn production reaching 4.15 tons ha^{-1}. Hasid *et al*. (2021) reported that the use of indigenous arbuscular mycorrhizal inoculum combined with 80 g of cow dung per planting hole was the best treatment for local corn plants with a production of 3.85 t ha^{-1} dry beans.

The research results of Husna *et al*. (2023) showed that the combination of Glomus claroideum treatment and administration of 5 ml Nasa LOF was able to increase the number of spores in the 3rd month and the number of spores after drying. Nasa LOF 5 ml is relatively applicable for the production of Glomus claroideum. The combination of LOF of gamal leaves and banana weevil produces higher rice yields than LOF of gamal leaves or banana weevil alone (Mollah *et al.*, 2021).

CONCLUSION

1. There is an interaction effect of kirinyuh weed LOF and AMF on stem diameter, number of leaves, ear length, number of rows per ear, weight of 100 seeds and productivity.
2. LOF treatment of kirinyuh weed independently had a significant effect on plant height, stem diameter, number of leaves, number of rows per ear, weight of 100 seeds and productivity, while AMF treatment had a significant effect on ear length, number of rows per ear, weight of 100 seeds and had a significant effect on has no real impact on productivity
3. LOF treatment of 30 mL L^{-1} water and AMF 15 g/plant hole is the best treatment for local corn production on marginal land in Southeast Sulawesi. Productivity

Acknowledgment

The author would like to thank the Dean of the Faculty of Agriculture who has provided the facilities to carry out this research.

REFERENCES

Amare, K., H. Zeleke, G. Bultosa. (2015). Variabilty for yield, yield related traits and association among traits of sorgum (Sorghum bicolor L. Moench) varieties in wollo. J. Plant Breed. Crop Sci. 7:125-133.

Anastasia R.M., Pandiangana, D., Siahaana, P., Tangapo, A.M. (2015). Pengujian pupuk organik cair dari eceng gondok (Eichhornia crassipes) terhadap pertumbuhan tanaman sawi (Brassica juncea). https://www.neliti.com/publications/115540/pengujian-pupuk-organik-cair-dari-eceng-gondok-eichhornia-crassipes-terhadap-per#id-section-content. DOI: 10.35799/jm.4.1.2015.6897

Deptan. (2011). Peraturan Menteri Pertanian Nomor 70/Permentan/SR.140/10/2011 tentang pupuk organik, pupuk hayati dan pembenah tanah. https://psp.pertanian.go.id/storage/545/Permentan-No.-70-Th.-2011-ttg-Pupuk-Organik-Pupuk-Hayati-dan-Pembenah-Tanah.pdf

Duaja, M. D. (2012) 'Pengaruh Bahan dan Dosis Kompos Cair Terhadap Pertumbuhan Selada (Lactuca sativa Sp.)', Jurnal Bioplantae, 1(1), pp. 10–18.

Fan , L., Zhang , P., Cao , F., Liu ,X., Ji , M., Xie , M. (2024). Effects of AMF on Maize Yield and Soil Microbial Community in Sandy and Saline Soils. Plants 2024, 13(15), 2056; https://doi.org/10.3390/plants13152056

Hadisuwito, S. (2012). Membuat Pupuk Organik Cair. PT. Agro Media Pustaka: Jakarta Selatan.

Hairiah. (2010). Pengelolaan Tanah Masam Secara Biologi. International Centre For Research in Agroforestry. Refleksi Pengalaman dari Lampung Utara. Bogor.

Halim. (2012). Peran Mikoriza Indigen Terhadap Indeks Kompetisi antara Tanaman Jagung (Zea mays L.) dengan Gulma Ageratum conyzoides. Berkala Penelitian Agronomi. Vol.1.No. 1: 86-92.

Halim, Arma MJ, Rembon FS and Resman. (2015). Impact of mycorrhiza fungi from grassland rhizosphere and liquid organic fertilizer to the growth and yield of sweet corn on Ultisol in South Konawe, Indonesia. Journal of Agriculture, Forestry and Fisheries. 4(5): 209-215.

Hartatik, W, Husnain & Widowati, L 2015, 'Peranan pupuk organik dalam peningkatan produktivitas tanah dan tanaman', Jurnal Sumberdaya Lahan, vol. 9, no. 2, pp. 107–12

Hasid, R. M.J. Arma, A. Nurmas. (2018). Research article existence arbuscula mycorrhiza and its application effect to several variety of corn plant (Zea mays L.) in marginal dry land. J. Biol. Sci., 21: 199-204. ISSN 1028-8880. DOI: 10.3923/pjbs.2018.199.204.

Hasid, R., M.J. Arma, A. Nurmas, Halim, M.W. Arsana. 2021. Research Article Effect of Indigenous Arbuscular Mycorrhizal Formulations with Cow Dung on Phosphorus Uptake, Growth and Yield of Local Corn (Zea mays L.) in Marginal Land. Asian J. of Plant Sci., Vol 20: 196-202. ISSN 1682-3974 DOI: 10.3923/ajps.

Hidayat C, Arief DH, Sauman J, Nurbaity A. (2019). Microaggregate and macroaggregate of andisol affected by arbuscular mycorrhizal fungi and rhizobacteria. IOP Conference Series: Earth and Environmental Science, 334(1): 1-5.

Husna, F. D. Tuheteru, A. Arif, Sijebir, Albasri, W. R. Nurdin, Parwito, and M. Zainun. (2023). Production of Arbuscular Mycorrhizal Spores by Providing Nasa Liquid Organic Fertilizer (LOF). Journal of Tropical Mycorrhiza, Vol 2 (2): 91-98. https://journal.ami-ri.org/index.php/JTM E-ISSN 2829-467X.

Ikhwana P, Andi E, Henry N B. (2015). Tanggap Pertumbuhan dan Hasil Tanaman Jagung Manis (Zea mays L. Saccharata) pada Aplikasi Berbagai Pupuk Organik. e-J. Agrotekbis, 3 (2) : 168 – 177.

Kasim, N., Amin, R., Mariyati, T., & Nurvitasari, E. (2019, October). Growth of passion fruit plants on various origins of cuttings and concentration of Liquid Organic Fertilizer. In IOP Conference Series: Earth and Environmental Science (Vol. 343, No. 1, p. 012029). IOP Publishing. https://doi.org/10.1088/1755-1315/343/1/012029

Mollah, A., Risal, M., Musa, Y., Yassi, A., & Dachlan, A. (2021, July). Growth and production of paddy rice (Oryza sativa L.) in various planting systems and types of liquid organic fertilizers. In IOP Conference Series: Earth and Environmental Science (Vol. 807, No. 4, p. 042055). IOP Publishing. https://doi.org/10.1088/1755-1315/807/4/042055

Munawar, A. (2011). Kesuburan Tanah dan Nutrisi Tanaman. pertama. Komalasari P, editor. Bogor (ID): PT Penerbit IPB Press.

Murdaningsih dan Mbu'u Y S. (2014). Pemanfaatan Kirinyuhh (Chromolaena odorata) Sebagai Sumber Bahan Organik Terhadap Pertumbuhan dan Hasil Tanaman Wortel (Daucus carota). Buana Sains, 14(2): 141-147.

Musfal. (2008). Efektivitas cendawan mikoriza Arbuskula (CMA) terhadap pemberian pupuk spesifik lokasi tanaman jagung pada tanah inceptisol.[tesis]. Medan (ID) :Universitas Sumatera Utara.

Musfal. (2010). Potensi cendawan mikoriza arbuskula untuk meningkatkan hasil tanaman jagung. Jurnal Penelitian dan Pengembangan Pertanian. 29(4):154–158. doi:10.21082/jp3.v29n4.2010.p154-158.

Muyasir, Nurhayati, Husna, R. (2022). Efek Pemberian Pupuk Hayati Mikoriza dan Kosentrasi Pupuk Organik Cair Terhadap Pertumbuhan dan Hasil Tanaman Jagung Manis (Zea mays saccharata Sturt.). Jurnal Agrotek Lestari Vol. 8 No. 1, April 2022 , PP: 60 – 69. http://jurnal.utu.ac.id/jagrotek/article/viewFile/5278/pdf

Nasaruddin. (2012). Efektifitas pemanfaatan Azotobacter chroococcum dan Mikoriza Arbuskula (Glomus sp) terhadap pertumbuhan dan ketersediaan hara tanaman kakao. Disertasi. Program Pasca Universitas Hasanuddin Makassar

Nasira, W., R. Adawiyah, Muhidin, G.R Sadimantara and D.N. Yusuf. 2021. Effect of liquid organic fertilizer derived from moringa on growth of upland red rice lines crosses from SE Sulawesi. IOP Conference Series: Earth and Environmental Science. 807 04203. https://iopscience.iop.org/article/10.1088/1755-1315/807/4/042037

Nurmas, A., Fitri, dan Gusnawaty H.S. (2017). Potensi azotobakter indigenius dan pupuk kandang dalam meningkatkan produksi jagung pulut lokal (Zea mays ceritina Kulesh) di Ultisol. Prosiding Seminar Nasional PERAGI. Bogor. Halaman 17-24.

Nurmas, A., Anas, A.A., Rezak, L.M., Adawiyah, R., Rahayu. (2021). Potensi daun komba-komba sebagai pupuk organik cair pada tanaman seledri (Apium graviolens L.) Prosiding Seminar Nasional Politeknik Pertanian Negeri Pangkajene Kepulauan. PANGKEP, 28 OKTOBER 2021. ISBN: 978-623-96172-3-3

Nurmas, A., Hasid, R., Prawati, M., Arma, M.J., Adawiyah, R. 2023. Application of organic fertilizer raw materials of chromolaena odorata and mycorrhizal fungi on local corn plant in sub-optimal land. Journal of Tropical Mycorrhiza, Vol 2 (2): 81-90. https://journal.ami-ri.org/index.php/JTM E-ISSN 2829-467X.

Oktafitria, D., Febriyantiningrum, K., Jadid, N., Nurfitria, N., RahmadanI, F., Amrullah, A., dan Hidayati, D. (2019). Assessment of reclamation success of former limestone quarries in Tuban, Indonesia, based on soil arthropod diversity and soil organic carbon content. Biodiversitas Journal of Biological Diversity, 20(6):1743-1747. DOI:

10.13057/biodiv/d200634

Prihantoro I, Rachim A, Aryanto A, & Karti P. (2015). Efektivitas perbanyakan kultur tunggal cendawan mikoriza arbuskula (Gigaspora margarita, Glomus etinucatum, Acaulospora tuberculata) pada inang Centrosema pubescens. Prosiding seminar-nasional IV HITPI .Lampung (ID): HITPI

Pujiwati, H., Setyowati, N., Wahyuni, D.D., Muktamar, Z. (2021). Growth and Yield of Soybean on Various Types and Concentrations of Liquid Organic Fertilizer in Ultisols. Journal of Applied Agricultural Science and Technology, 5(2): 74-83. DOI:10.32530/jaast.v5i2.28

Puteri, A. R., Setyowati, N., & Muktamar, Z. (2021). Growth and yield of sweet corn (Zea mays L. Saccharata) as affected by incubation time of preparation for tithonia (Tithonia diversifolia) enriched liquid organic fertilizer. In IOP Conference Series: Earth and Environmental Science (Vol. 637, No. 1, p. 012090). IOP Publishing. https://doi.org/10.1088/1755-1315/637/1/01209

Ridwan, I., Musa, Y., Khadijah, S., Farid, M., Sjahril, R., & Ulfa, F. (2020, April). Response of Soybean (Glycine max L.) to Arbuscular Mycorrhizal Fungi (AMF) applied with organic liquid fertilizer. In IOP Conference Series: Earth and Environmental Science (Vol. 486, No. 1, p. 012114). IOP Publishing. https://doi.org/10.1088/1755-1315/486/1/012114

Rivana E, Indriani NP, Khairani L. (2016). Pengaruh Pemupukan Fosfor dan Inokulasi Fungi Mikoriza Arbuskula (FMA) Terhadap Pertumbuhan dan Produksi Tanaman Sorghum (Sorghum bicolor L.). Jurnal Ilmu Ternak. 16(1)234-240.

Roni N, Candraasih N, Witariadi N, & Siti N. (2015). Pertumbuhan kacang pinto (Arachis pintoi) yang diberi pupuk kandang sapi dan mikoriza. Seminar Nasional IV HITPI. Purwokerto (ID) : HITPI p. 94–98

Soenartiningsih. (2013). Potensi cendawan mikoriza arbuskular sebagai media pengendalian penyakit busuk pelepah pada jagung. IPTEK Tanaman Pangan. 8:48–53.

Sukiman, H. (2015). Pemanfaatan Mikoriza Untuk Meningkatkan Kualitas Bibit Pohon dan Produktivitas Lahan Kawasan Perkotaan. Prosiding Seminar Nasional Masyarakat Biodiversitas Indonesia. Vol 1 Nomor 8. ISSN: 2407-8050 : hal.2021-2026.

Talanca H. (2010). Status cendawan mikoriza vesikular arbuskular (MVA) pada tanaman. Prosiding Pekan Serealia Nasional. Sulawesi Selatan. Balai Penelitian Tanaman Serealia.

Tsaniya, A. R., Dewi, E. N., & Anggo, A. D. (2021, July). Characteristics of liquid organic fertilizer from different composition types of seaweed between Gracilaria sp. and Sargassum sp. In Journal of Physics: Conference Series (Vol. 1943, No. 1, p. 012071). IOP Publishing. https://doi.org/10.1088/1742-6596/1943/1/012071

Wahyu, E.R, Purwani KI & Nurhatika S. (2013). Pengaruh Glomus fasciculatum pada pertumbuhan vegetatif kedelai yang terinfeksi Sclerotium rolfsii. Jurnal Sains dan Seni POMITS. 2(2):64–68.

Department of Agrotechnology, Faculty of Agriculture, Halu Oleo University, Kendari, Southeast Sulawesi, 93232 Indonesia

Zuhry E dan Puspita F. 2008. Pemberian Cendawan Mikoriza Arbuskular (CMA) Pada Tanah Podzolik Merah Kuning (PMK) Terhadap Pertumbuhan Dan Produksi Kedelai (Glycine max (L.) Merill). Sagu 7(2): 25-29.