

# APPLICATION OF SEVERAL TYPES OF REFUGIA AND INTERCROPPING PATTERNS OF TOPO ONIONS, CHILI AND TOMATOES ON SUBOPTIMAL DRY LAND

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**Abstract.** Global warming can have an impact on the environment and plants. Prolonged global warming can increase drought, one of which is a lack of water, both in land and plants. Plants that experience drought can increase pest and disease attacks. For this reason, it is necessary to carry out research on the application of several types of refugia and intercropping patterns for topo onions, chilies and tomatoes on suboptimal dry land. The aim of this research is to find out how much influence the types of refugia have on top onion, chili and tomato plants in dry land. To determine the effect of the intercropping system on topo onions, chilies and tomatoes in dry land. The research was carried out in West Halmahera Regency, North Maluku Province. The design used was a split plot design with three replications. The first factor, as the main plot, is the refugia consisting of R1: Aster Flowers and R2: Gemitir Flowers (chicken taek). The second factor is a subplot consisting of I1: Topo onions, I2: Chilies and I3: Tomatoes. The morphological variables observed were plant height, stem diameter, number of leaves, number of fruit, fruit diameter and fruit weight. Data were analyzed using SAS, if there was a significant effect, it was continued using the Duncan test at the 5% level. The results of the research showed that the use of refugia plants, both R1 and R2, significantly affected plant height, stem diameter, number of leaves, number of fruit, fruit diameter and fruit weight compared to plants that did not use refugia treatment. Plants using the intercropping system provided by refugia plants can increase crop production and reduce pest attacks. This shows that dry land can be used as competent agricultural land.

**Keywords:** Refugea, intercropping, Topo Onions, Chilies, Tomatoes

## 1. INTRODUCTION

North Maluku is an area with a tropical climate, there are many dry lands that are not used by the community. Most people live on farming. Agriculture for the community has an important meaning as a source of food and a source of life. Agriculture focuses on horticultural crops, which is one of the subsectors that plays a role in fulfilling community nutrition. Horticultural plants that are widely developed are: vegetables and fruit, such as: topo onions, chilies, Chinese cabbage and tomatoes. Horticultural plants such as topo onions, chilies and tomatoes are plants that can be cultivated in the highlands and have advantages, because they have high demand value so they can be cultivated by farmers intensively. However, large plantations that specifically cultivate these crops have limited development, due to low productivity. One factor in

low production is pest attacks. Pests that attack horticultural plants need to be controlled (Efrin *et al.*, 2021). Pest and disease control can be done by using an intercropping system or intercropping system.

The intercropping system can reduce the risk of crop failure to a very small extent. Based on several considerations according to the results of horticultural plants that are seen as not being able to meet the needs of the people of North Maluku, so they still get exports from other regions such as Manado, Makassar and Java, for this reason research is being carried out on horticultural plants using an intercropping system to control pests and diseases on campus IV University. Khairun Province North Maluku as a determinant of the potential of horticultural plants for plant development to support cultivation programs to obtain maximum profits,

both to meet household needs and for sale. Farmers in carrying out farming allocate existing resources effectively and efficiently to gain profits.

## 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

### Refugea

Mustarin et. all, (2023) said that refugia plants are one of the plants or weeds that can be used as natural pesticides, because they have the potential as predators and parasitoids. Natural pesticides that are used can preserve natural enemies such as butterflies, beetles and bees. Refugia plants can be used in rice fields, and plantations, so that natural predators do not disturb cultivated plants.

Refugia plants are plants that flower like ornamental plants or weeds, these plants have many benefits, namely as food, and shelter. One of the plants that can be used as a protective plant is daisy and gemilir. Daisies and gemilir plants are flower plants that are used as ornamental plants that are converted into refugia plants. In addition to providing food, these plants also have a scent that is highly favoured by predators.

The daisy plant and the gemilir plant are flower plants that bloom all the time without seasonality, that is, the flowers will bloom all the time. Asn Gemitir plants can grow anywhere. Taxonomically, Aster and Gemitir plants can be classified as:

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Kingdom: Plantae  
 Division: Magnoliophyta  
 Class: Dichotyledones  
 Order: Asterales  
 Family: Asteraceae  
 Genus : Callitrophus  
 Species: *Callitrophus chinensis* (L.) Nees

### Classification of Gemitir Plant

Kingdom : Plantae  
 Division: Magnoliophyta  
 Class : Dichotyledones  
 Order: Asterales  
 Family: Asteraceae  
 Genus: Tagetes  
 Species : *Tagetes erecta* (L.)

### Intercropping

Intercropping is a cropping pattern carried out on one field of land using more than one type of plant. The intercropping pattern can increase the production of cultivated plants. This is done to reduce the increasingly limited agricultural land, so that the intercropping pattern is an alternative land

use productivity and efficiency (Surtinah et al. 2016).

The use of Intercropping patterns can obtain optimal production, maintain soil fertility and reduce the risk of failure of one of the mixed crops, and the yield of the combination of plants per unit area can be higher than the monoculture system if the composition of plants and plant spacing in intercropping patterns are arranged properly (Ekayujaya, 2019).

Intercropping patterns can optimise plants in the use of nutrients, water, sunlight so that plants can produce efficiently (Du et al., 2018). according to Surtinah et al. (2016) Intercropping patterns are able to emphasise the use of fertilisers and pesticides, excessive water use, and reduce the risk of crop failure. This is in accordance with research conducted by (Madembo et al., 2020) which says that intercropping plants must be considered a combination of plants so that there is no competition for nutrients, water and sunlight and can control pests and diseases.

### Hypotesis

Research with the title Application of Several Types of Refugea and Intercropping Patterns of Topo Onions, Chili and Tomatoes on Suboptimal Dry Land, it can be hypotesa that

1. the use of refugea plants can be useful for crop production, especially in protecting plants against pests and diseases,
2. The use of intercropping cropping patterns can increase crop production yields
3. The use of intercropping patterns and the utilisation of refugea plants can be developed on dry land

## 3. RESEARCH METHODS

Place and Time of Research This research was carried out in West Halmahera Regency, North Maluku Province. This location research was carried out at Bangko Campus IV, Faculty of Agriculture, Khairun University, Ternate. The research was carried out from April to October 2023.

Experimental Design Data This research was arranged factorially using a randomized block design (RAK) experimental method, with two factors, namely: The first factor is the type of refugea plant, consisting of: R1: Aster Flowers, R2: Gemitir Flowers (chicken taek). The second factor is the Intercropping Pattern (intercropping), consisting of: I1: Topo Onions I2: Chilies I3: Tomatoes. Thus, in total, 6 treatment combinations were obtained. Each treatment was repeated three times, so there were 18 experimental units. Each experiment consisted of 8 seeds, so the number of seeds used was 144 plant seeds.

The data obtained were analyzed using the F test using the SAS program and if the effect is statistically significant ( $\alpha 5$ ), then further tests using

Duncan Multiple Range Test (DRMT) the experimental design Model used is as follows:  $Y_{ijk} = \mu + R_k + P_i + \delta_{ik} + K_j + (PK) + \epsilon_{ijk}$

#### 4. RESULTS AND DISCUSSION

Agricultural land used for research is a loose forest that was used for the first time to conduct research land that will be planted with horticultural crops. Where the new land is a forest land filled with large trees, then logging, cleaning and processing are carried out. After cleaning, agricultural land can be seen as dry land lacking water and nutrients, and more easily attacked by pests and diseases. This land has no source of water. which water source depends only on the annual rainfall, so the cultivation of plants is very difficult to cultivate.

Planting horticultural crops in dry land can cause plants to wither and die. For that, sowing is done first as determined by Sumarni et., al., (2009) about the cultivation of chili plants before planting in the field, first carried out seeding. While topo onion planting can be done directly in the field by using onion seeds.

Planting horticultural crops on dry land is very susceptible to pests and diseases, it is necessary to treat by providing natural pesticides such as refugea plants. refugea plants planted on the sidelines of horticultural crops.

##### High Plant

The results of diversity analysis showed that refugea plants (natural pesticides) significantly affect the height of tomatoes, peppers and topo onions. At the age of 4 and 6 weeks after planting (Table 1).

Table 1. The effect of Refugea on plant height (cm) in tomato, chili and topo onion plants at the age of 4 and 6 weeks after planting.

Varietas Refugea	Chili	Tomato	Topo Onion
Aster	63.33a	75.60a	30.39a
Gemitir	58.8ab	73.22ab	29.76ab

Ex: The number followed by the same letter does not differ significantly from the DMRT level of 5%..

The results showed that of the three varieties of horticultural crops showed that the treatment of refugea plants had a significant effect on the growth of chili plants, tomatoes and topo onions. Plant height in the three varieties of horticultural crops and planting treatment refugea (natural pesticides) showed that the treatment of aster plants give the highest results in chili plants, tomatoes and onions Topo compared with refugea (Gemitir). This shows that aster plants have a higher attraction that invites insects compared to gemitir plants.

Plant height increase is a physiological process by which cells divide. Plant height is a form of increased cell division and enlargement from photosynthesis. In the division process, plants require essential nutrients in sufficient quantities for plants through the roots. According to Lakitan (2011) shows that the results of photosynthesis in the vegetative growth phase translocated to the stem so that the plant height increases.

The treatment of refugea plants (natural pesticides) can counteract or reduce pest attacks on horticultural crops. According to Trinawati (2016), giving refugea plants can attract insects, because refugea has a more attractive color and smell that insects like.

The treatment of refugea plants has a different color and character and is very interesting compared to horticultural crops. Djojsumarto (2004) said that refugea plants can control and prevent pests or diseases that damage plants, plant parts or agricultural products and animals that can cause disease in humans and animals that need to be protected, with the use of plants, soil and water. Protection of horticultural crops from pests can promote optimal growth so that the growth and development of plants will be disrupted and crop production is not optimal.

##### Rod Diameter

The results of variety analysis showed that the provision of refugea plants (natural pesticides) significantly affect the stem diameter of peppers, tomatoes and topo onions at the age of 6 mst (Table 2).

Table 2. The average stem Diameter of chili plants, tomatoes and onions topo at 6 mst.

Varietas Refugea	Chili	Tomato	Topo Onion
Aster	110.43a	187.65a	4.33 a
Gemitir	107,24ab	169.53ab	4.00ab

Ex: The number followed by the same letter does not differ significantly from the DMRT level of 5%..

Based on the results of the analysis showed that the treatment of refugea plants showed a significant effect on the number of fruits per plant and fruit weight per plant in chili plants, tomatoes and onions topo. Refugea planting produces the highest average number of fruits per plant, namely 110.43 in refugea (aster) chili plants, 187.65 tomato plants and 4.33 topo onions.

Fertilization of plants greatly affects the growth and development of plants, so the provision of manure in this case pigeon droppings. According to Musahidin *et.all.*, 2022, that bird droppings contain high NPK nutrients. This is in accordance

with the words of Hardjadi (2002), which states that the formation and filling of fruit is strongly influenced by nutrients N, P, and K that will be used for photosynthesis as a constituent of carbohydrates, proteins, minerals, vitamins, and fats that will be translocated to the storage of fruit.

According to Setyamidjaja (1986), element N plays a role in accelerating the conversion of carbohydrates into proteins that affect the division, elongation, enlargement of new cells so as to accelerate the growth of fruit. Element P is an important element in the formation of fruit because element P converts carbohydrates into other compounds such as sugar into flour whose results will affect the formation of fruit (Jayadi, 2022).

According to Hasan *et al.*, 2022 that element K plays a role in the process of photosynthesis associated with photosynthetic power and translocation of assimilates to the fruit part. Sufficient nutrient uptake will have an impact on the amount of fruit and fruit weight produced. The number of fruits per plant and the weight of fruits per horticultural crop show results that tend to increase, with the administration or planting of natural pesticides that can protect plants from pest attacks.

On dry land can increase the population of pests, then by planting plants refugia is an alternative, because the plants can be protected and safe for humans to consume.

**Fruit weight**

The results of variety analysis showed that the provision of plant refugia (natural pesticides significantly affect the weight of chili, tomato and onion bulbs topo at harvest time to 1,2 and 3 (Table 5).

Table 5. The average fruit weight of chili plants, tomatoes and onions topo at 6 mst.

Varietas Refugea	Chili	Tomato	Topo Onion
Aster	162.73a	180.33a	17.06a
Gemitir	118.6ab	160.0ab	16.21ab

Ex: The number followed by the same letter does not differ significantly from the DMRT level of 5%..

The results of the analysis showed that the fruit weight of chili plants, tomatoes and onions topo showed the highest results in the treatment of aster plants are not significantly different from the gemitir plants. According to Munawir *et al* (2019), refugia plants contain alkaloids, saponins, flavonoids, tannins and terpenoids.

The active ingredients in refugia plants are able to protect horticultural crops from pest attacks, resulting in high fruit weight. Tanama refugia can be used as a natural pesticide that is not harmful to

plants and can be used continuously, can be available to plants.

The vegetative growth of the plant is greatly influenced by the weight of the fruit. Based on the analysis of plant diversity, the treatment of refugia plants does not significantly affect the weight per fruit. This is thought to be due to environmental factors that affect the growth and yield of horticultural crops such as chili plants, tomatoes and onions topo ( Munawir *et al.*, 2019).

This is thought to be because the newly opened land still has shady trees around the plant, which cover horticultural crops, so it can affect the fruit weight of chili, tomato and onion topo plants. Apart from environmental factors, temperature factors can also affect the weight of the fruit it shows that the average daily temperature during the study ranged from 35-37°C, has a high level of heat. This is contrary to the opinion of Sukaryan *et.al.*, (2023), about the desired temperature of chili plants that range around 27°C.

**5. CONCLUSION**

The conclusion is The use of natural pesticides (refugia) such as daisies and gemitir plants can protect horticultural crops from pests and diseases, without providing harmful effects to humans. Cultivation of horticultural crops with intercropping system can provide increased yields. Treatment of refugia plants in horticultural crops with intercropping system can suppress pest attacks and increase production.

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