The fertile soil is characterized by the species *Balande*, *Karihu-rihu* (*Lantana camara* L.), Melinjo (*Gnetumgnemon* L.), and *Tomboloruha* species. The less fertile soil is characterized by *Alang-alang* (*Imperata cilindrica* L.) and *Komba-komba* (*Eupatorium odoratum* L.) and pasture spesies vegetation. Land which is dominated by pile vegetation, saplings and a few trees is the selected land. Soil depth is measured based on forecast analysis of the sound of ground knocking using a small crowbar. Differences in depth that produce different sonar sounds. Community farm are a legacy from previous generations, in order to avoid land conflicts, the selected land is marked (*totari*) on the first day of land preparation. The sign is a piece of vegetation that is placed on the ground and pressed with a stone.

Land clearing is carried out by pulling grass, cutting affordable grass, and then cutting down trees and land (Table 1). The vegetation of the seedlings in the form of grass is removed and then collected. Vegetation the size of poles, stakes, or trees in the pruning of lower branches, and branches is then collected. Clearing the land is then followed by trimming the branches and branches in the middle to provide access for farmers to all parts of the land. Vegetation poles, stakes or dense trees will be felled to adjust the spacing. The eliminated saplings or trees will be brought in the farm outside and used as a source of firewood.

The next land clearing is by trimming the upper branches, and branches of vegetation with the size of poles and trees. The pruning results in the form of chopping are cut into one cubit size and then collected in one place. The felling is allowed to dry and rot naturally. The pole-sized vegetation can be used for climbing plants for Red Beans, Long Bean plants, and Uwi plants. This means that the climbing pole or living and / or stalking pole comes from naturally growing vegetation. Farmers grow wild trees in the fields for food, traditional medicine and ceremonies materials, as well as farmers' perceptions of their availability in nature (Assogbadjo et al., 2012), and land tenure security (Ruseva et al., 2015)..

3.2 Modification of the Vegetation Canopy

Modification of the vegetation canopy after drying and weathering of the trimmings of branches and twigs due to changes in weather and activity. The selected vegetation with modified crowns is vegetation that has been tested and developed by farmers from generation to generation. The process of modifying the vegetation canopy begins by taking the selected cardinal directions, namely north-south or south-north. The direction and position of the farmer-vegetation chosen aims to maximizing lighting, both before modification of the vegetation canopy and after modification of the vegetation canopy. Lighting prior to modification of the vegetation canopy is important for the farmer in determining the vegetation pruning point. Lighting after crown modification is important for plant growth and production in the *welia* soil-crop system.

Modification of the vegetation canopy by slashing or cutting the canopy as high as 150-180 cm. Cutting the crown is done from the top to the bottom. The result of slashing or cutting the vegetation is used as a climbing platform for Red Beans in the local language called *weli*. The remaining branches and twigs of vegetation that are not used as climbing poles or stakes are cut into several parts which are then collected on the ground surface among the *weli* candidates.

The results of field observations show that there are several levels of vegetation piles on the ground. It places between the prospective climbing poles or stakes. First, the pile of vegetation on the ground consists of a grass pile that is almost decaying. Second, a pile of dried branches and twigs. Third, the final pile is a top vegetation canopy of pile as a felling result from the vegetation canopy modification process. Each level of vegetation pile on the ground surface shows a different color due to the interaction with environmental elements.

Vegetation of poles has been modified for climbing poles or stakes. It is according to farmers' preferences or at most the height of the person cutting them. The climbing pole or stake starts at mouth level to the highest end of the owner welia hair's. Vegetation found in the boundary area is used as a climbing pole or stake. Therefore, the height of the climbing pole or stake can be a land ownership feature. *Welia* have not a stone fence. The farm boundary consists of some vegetation. Each farmer has certain preferences in designing climbing poles or stakes such as height and cutting patterns. The cutting pattern of climbing poles or stakes is influenced by being left-handed or right-handed.

The results of interviews with farmers show that to facilitate the cutting poles process, the best body position is in a position perpendicular to the pole vegetation. Farmers can save the kinetic energy of cutting the pile and create the optimal force moment for cutting the pile. *Welia* cannot be practiced in secondary forest which is dominated by vegetation the size of saplings and trees or on land that has no vegetation. This indicates that the growing vegetation must be maintained in preparation for the prospective climbing pole or stake vegetation in the

coming planting season. Selectivity allows prospective climbing poles or stakes to develop and dominate a land.

3.3 Burning of Vegetation

Burning of vegetation piles in *welia* is a sensitive activity in optimizing the success of crop production. Important aspects of land burning are the decay level of the logged vegetation on the soil surface, the volume of vegetation burned, and the characteristics of *welia*. Weathering of logged vegetation on the soil surface can be seen from the growth of grass. Fuel volume regulation is carried out by evenly spreading the felling over the ground of entire surface. The characteristic of Welia that is ready to burn is that a shoot has appeared at the end of the climbing pole or stake.

Figure 1 *Welia* ready to burn

Before the land is burned, the farmer made a control line or illusion on the land edge. Control line or illusion is an unburned area on the land land. The size of the control line or illusion is adjusted to the needs. Several things cause differences in the width of the control line or illusion. The difference is caused by the degree of the burned vegetation dryness, the thickness of the burned vegetation, wind speed, land characteristics, and farmer characteristics..

The dryness degree of the burned vegetation determines the width of the control line or illumination. The burnt vegetation drier, then wider of control line or illuminance is made. Ottmar et al. (2007) reported that the characteristics of the fuel influence fire behavior include moisture content and chemical composition. Rainfall and temperature affect the moisture content of the burning material (Ramberg, 2020). The thickness of the burnt vegetation and the wind speed, the thicker the vegetation that is burned, the wider the control line or illusion is made, as well as the wind if it blows hard, it can be done widening the control line or illusion. Figure 1 shows *welia* ready to burn. Logging of vegetation that is the size of saplings and trees. It is set aside in the area around the control line or shade, so that it does not become part of the burn. Derik (2019) stated that land fires did not occur during the cultivation practice period.

Burning starts from the direction opposite to the wind direction along the control line area or illusion. It make fire can be controlled. The flames have met in the entire control line area has been burned, so the combustion is carried out from the direction of the wind. This action is expected to bring together hotspots in a land, promote the conductivity of fire or heat to parts that have not been burned. Burning is carried out after rain has wetted all the cut vegetation that has long dried up to the surface of the soil, filling pores in the soil and rocks. Farmers use fire to clear land under cultivation (Wallenfang et al., 2015; Jacobson, 2014; Rösch et al., 2017). The results of field observations indicated that in the burned land, many new shoots appeared on the lateral roots and more seeds were found in new vegetation, if compared to the land that was not burned. Darwiati and Tuheteru (2010) state that the adaptation of vegetation to fire includes shoot protection, stimulation of flowering and seed retention. Water that is in the clearing of dry vegetation can stimulate the formation of smoke where the more moisture content in the leaves and branches is burned, the greater the amount of smoke formed.

Figure 2 Impact of Burning in *welia* on the Rhizosphere

Figure 2. shows the impact of welia's internal combustion on the rhizosphere. The controlled burning indicators of soil and rock are not change color and burn. The process of burning land is a wise and measured activity in which burning the land by heating the soil but not scorching the soil, the stones and troots in the soil, climbing poles or stakes and forming charcoal. In addition, it does not damage the ecological structure of the soil, burning the land even if necessary does not kill soil microorganisms. According to farmers, these things have a positive impact on the growth and production of Red Beans and Corn plants.

According to farmers, uncontrolled burning has a negative impact on the growth and production of

kidney beans and vegetation after burning. The characteristics of a fire that soil scorches are blackish color on the ground disappears, shifts to a reddish color and scorches the rock (*kepuo*), burning the lateral roots that are below the ground surface and the twigs, and branches to ashes. The impact of uncontrolled burning gave rise to seedling vegetation in the form of grass or alang alang which was dominant over woody seedling vegetation. The dominance of grass vegetation in a land after land burning indicates that the heat oxidized in the combustion exceeds the carrying capacity of soil and rock.

Empirical burning of land which actually contributes positively to Welia which supports the research results of Kukla et al. (2019), Mulyoutami et al. (2010), Sasaoka et al. (2014) and Dressler and Pulhin (2010). They can prove that in the end, controlled fire cultivation does not lead to land and forest degradation. The combustion specified must be carefully planned to prevent long-term disruption of the Carbon and Phosphorus cycle (Merino et al., 2019) as well as land fires.

3.4 Planting Preparation

Determination of planting time according to traditional meteorological calculations (*kutika*). It is followed by natural phenomena, namely the position of the moon to the sun and stars, the appearance of vegetation, and animal behavior. Farmers can predict the amount of rainfall in a year with traditional meteorological calculations and astrology. This amount is known from the cloud concentration at the position of the Pari Star (*sangia*) and the moon. Observation time is when *Sangia* rises to sets at the beginning of the western season. The concentration of clouds around *sangia* has a positive correlation with the amount of rainfall in the western monsoon. The Rakai tribe in Uganda understands four important components in a knowledge system [43]. The four important components namely long-standing familiarity with seasonal patterns of rainfall and temperatura; a set of traditional local climate indicators; observation of meteorological events, and information about shifting seasons. Forecasts for planting preparation in relation to the availability of rainwater are the basis for determining the appropriate planting year.

The ideal planting time is done a few days after rain and after burning the land. Rainwater pressure can facilitate the entry of ash into soil pores and the nature of water is able to penetrate rocks. Information on rain will fall in the next week for planting time, if the sun's sunset distance from the Cape of Kapota Island is almost 1 meter accompanied by lightning and reddish clouds. Information on natural phenomena is supported by the condition of flora such as *Kalele* fruit which is released from the fruit stalk, and then blown by the wind until it reaches the atoll (*pasi*). The information stability on natural phenomena and the condition of the flora is supported by information on the fauna state in the form of animal behavior, namely the migration of *Boronang* fish (*Siganus* Sp) to coastal areas to spawn. Other flora information such as *Laron* (*Macrotermes gilvus*) gather around the light source at night.

3.5 Planting Patterns and Types of Plants

The general cropping pattern can be categorized as intercropping. Intercropping begins with the planting of red bean and corn plants, which spacing following the climbing pole or stake. Based on Figure 3, it can be seen that the planting pattern and types of plants depend on the farmers preferences. Cassava planting when the corn has five leaves (*tombolo*). Irregular spacing follows the contour and landscape (Figure 3). Red bean plants are not planted with uwi plants, while corn and cassava plants are in one cropping pattern. Types of vegetable crops come from Long Beans and the *Cucurbitacea* group such as Pumpkin, Cucumber, and luffa (Figure 3.c). Cassava and uwi (*Dioscorea* spp) plants are types end cropping patterns. Vegetables are grown when lightning and thunder go hand in hand.

Figure 3. Planting Patterns and Plant Types in *welia*; (a)Corn-Red Beans-Cassava, (b)Corn-Red Beans-Cassava, (c)Corn-Red Beans-Cassava-Pumpkin, and (d) Corn-Cassava-Tubers

Red bean and corn plant populations were higher than those of cassava and Uwi plants. Seeds are prepared at the growing season ended or shortly after harvest. Welia prepared pithy seeds from Red Beans (*Phaseolus vulgaris* L.), Tubers, and Corn

(*Zea mays* L.) while the seeds prepared were vegetables, Coconut (*Cocos Nucifera* L.), Jackfruit (*Mangifera indica* L.) or tree species such as biti wood (*vitex copasus*). Vegetable and coconut seeds are prepared through a nursery, while fruit or wood is obtained from yards, farm, or around the forest. Tubers and kidney bean seeds are stored at home in dry and cool conditions. This aims to protect the tubers and seeds from physical damage.

3.6. Planting

Planting is an investment of plant seeds into the soil. Indirect planting using a crowbar or stick wooden (*tugal*). Planting begins with the uwi plant a week before it rains. Place the planting hole in the find direction from the climbing pole or stake, so that the young shoots can propagate and climb easily, or not against the wind direction. The people of Wangi-Wangi Island collect uwi 23 cultivars (Bahrun et al., 1998), Cassava (*Manihiot utilissima* L.) collected 12 cultivars (Harviyaddin, 2005) and Corn (*Zea Mays* L.) collected 36 cultivars (Safuan and Hadini, 2012). The cultivar collection increases with each growing season. This is due to the entry of cultivars from the area around Wangi-Wangi Island every planting season.

Red bean plant seeds are placed in the direction of the wind from the climbing pole or stake so that the young shoots propagate and climb easily to wrap around the climbing pole or stake. Corn plant seeds are placed in front of the red bean plant seeds, but between them with climbing poles or stakes. So that young red bean plant shoots do not reach the corn plant to be crawled. There is already a barrier in the form of a climbing pole or stake. Climbing poles or stakes that have been planted with uwi plants cannot be used for red bean plants. *Welia*'s limitation is the culture of choosing the plants types that are developed, namely staple plants, red beans, corn plants, and tubers. Local culture limits farmers from integrating superior varieties and species (Fernández-Ferrín et al., 2018, Berkes et al., 1995) but is open to the entry of local superior varieties and species of red bean and tuber crops.

3.7 Plant Maintenance

Red beans, corns, and growing tubers are maintained by applying fertilization, controlling weeds, controlling pests and diseases, and without watering. Red Bean plants are sure to be wrapped around a climbing pole or stake. The fertilizers used are organic fertilizers such as manure, combustion residue, household organic waste, and soil under the house.

Weeds are controlled mechanically using a special tool which in the local language is called *ka'ofu* or *kali*. Weed control, especially grass vegetation, is carried out once during the harvest. Weeds that have been uprooted collect at the surface of the soil. Weed control in the form of seedling vegetation selectively. Red bean plants, corn plants and seedling vegetation are allowed to grow together, so that they become the initiators of climbing poles or stakes (Figure 3.b and Figure 3.c).

Pests commonly encountered by farmers are Grasshoppers (*Caelifera*), Termites (*Isoptera*), Rats (*Muridae*), Ants (*Hymenopter*a), Older Parrots (*Cacatuidae*), Parrots (*Psittacoidea*), and Sangit Walang (*Leptocorisa oratorius*). Rats are the most harmful pests for farmers. Farmers have agronomic control. Walang Sangit is controlled by using natural enemies, namely *Rang-rang* Ants (*Oecophylla*) which are placed on climbing poles or stakes. *Rang-rang* Ants population can be increased by placing fish bones on climbing poles or stakes. Farmers control the fungus by applying kitchen ash to the affected parts of the plant. The interviews results with farmers showed that the ants were controlled by watering the *Kalumpa* fruit juice.

3.8 Harvest

Kidney beans are harvested when the pods have dried. This indicates that the seeds are physiologically ripe and marked by dry ripe seeds. Picking the pods should not be too late, because the pods are broken and lost a lot of seeds. There is no fruit picking when it rains, because it can reduce productivity. Low quality seeds are wrinkled seeds. The red bean plants that have been harvested are left to rot in *welia*. This means that the produce that is brought home is only in the form of pods, while the rest is left to remain on *welia*'s land.

The corn crop yields are separated into several groups, namely for consumption, sale and those stored as seeds in the following planting season. Corn for seed or sold in the market is stored in the kitchen or around the stove. The interview results with farmers found that storing the corn crop in the kitchen or around the stove can reduce the attack of fungi that can potentially damage the seeds. The results of testing the moisture content of seeds at the Laboratory of Seed Technology, Faculty of Agriculture, Halu Oleo University, showed that the red bean plant seeds had a moisture content of 13.37% while corn seeds had a moisture content of 12.67%.

Cassava harvest ages range from 8 to 18 months, depending on cassava cultivar. This means that tubers can be delayed harvest time. Farmers persist

and persevere in managing *welia* even though physically it appears as dry and rocky land. Hidrawati (2017) states that the intrinsic motivation of the community that supports subsistence food security in a sustainable manner. It is the desire to be a winner (*hoppotallo*) in conquering nature on land, namely karst rock terraces and steep waves in the ocean. Farmers always adhere to the principles of local wisdom as a characteristic of *welia* starting from land preparation, planting, maintenance and harvesting. Characteristik of *welia*'s create by farmers' life experiences and are used by farmers for the continuity of social interactions and interactions with environmental changes.

Today, the techniques maintained ethno-agronomically in *welia* are techniques that have proven to be better than other techniques. Observations over a long period of time (Sunaryo and Joshi, 2003). This is intended to ensure that local people inherit local knowledge and local wisdom such as local knowledge in the Moronene community in rice cultivation (Arafah, 2002; Limba et al., 2017), lowland rice (Sumitri, 2015), Cashew (Widiatmaka et al. , 2015). This practice fulfills primary needs through agricultural activities and the basic assumptions of managers and analyzers (Mitchell et al., 2000) for planning agricultural system development (Husnah et al., 2015).

The characteristics of welia are rainfed and slash-and-burn by maintaining tree-sized vegetation as a shade tree (*toropanga*). Modification of the vegetation canopy or shoot architecture for climbing poles or stakes. It is for secondary crops according to plant preferences. This climbing pole or stake is actually intended for conservation purposes. Climbing poles or stakes are made stakes as well as acting as stakes when farmers plant Red Beans. Although the main goal is to make vegetation succession rapidly, so that soil fertility develops even faster as well as to maintain species diversity. *Welia* divides the light spectrum through cropping patterns or canopy pairs in intercropping, and integrated cropping patterns with developed agriculture, especially mixed agriculture such as plantation crops or local forestry crops.

4 Conclusion

Welia is local wisdom in cultivating plants on dry land and dry climate. This system was born from a farming culture (ethno-agronomy) and centered on land (agrocentric). *Welia* with a pair of red bean and corn by 100% canopy follow lighting will have optimal crop production. The vegetation in Welia consists of climbing poles or stakes and shade trees (*toropanga*) in maintaining soil fertility to support plant productivity. *Welia* is a land management system that relies on vegetation and fire. Farmers should use fire wisely as agrotechnology in burning land. The wise use of fire can support the sustainability of *welia*'s vegetation

Ethno-agronomic studies, the development of soil fertility, and plant productivity on dry land with dry climates in *welia* are important to add scientific information for scientific publications. The results of this study also have important benefits in the transformation, transmission and development policies of *welia* according to civilization. Based on the description above, the conceptualization of *welia* as an alternative land use for Wangi-Wangi Island based on the problems of land, forest, and household food for farmers.

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