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Intercovery Siam Orange Plants with Seasonal Plants using The Leisa System

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A B S T R A C T

This research aims to determine the response to the concentration of liquid organic fertilizer from citrus fruit waste (LB) in the intercropping pattern between Siamese orange plants as staple crops and annual plants, namely cabbage and chili peppers (T), through the leisa system. This research is field research carried out in Bayung Gede Village, Kintamani District, Bangli Regency from March to December 2023. This research used a Randomized Group Design (RAK) with 2 factors arranged factorially. The first factor tried was liquid organic fertilizer from citrus fruit waste which consisted of 3 levels, namely LB0 (Control = 0 lt/plant), LB1 (2 lt/plant) and LB2 (4 lt/plant), while the second factor tried was the intercropping pattern. (T) which consists of 3 levels, namely T0 (without intercropping), T1 (intercropping Siamese oranges with cabbage plants), T2 (intercropping Siamese oranges with chili plants), so there are 9 treatment combinations, each repeated 3 times so that there are 27 trees. Each one is required. From the results of observations made on the intercropping pattern of Siamese Lombok oranges, the results were not significant for the intercropping pattern of Siamese oranges with cabbage, but it was significantly different from the control, namely 289 fruits/plant, the formation of Fruit-set of 145 fruits/plant increased by 99.31

INTRODUCTION

The use of inorganic agroinputs is something that has been done for many years, since the Green Revolution was promoted in Indonesia in the 1970s [21]. Inorganic materials such as fertilizers, pesticides, growth hormones and other inorganic materials have benefits for supporting plant growth and yields. However, inappropriate use of inorganic materials in the long term can be dangerous for human health, including poisoning, respiratory problems, and disruption of the body's organ systems and functioning [2][4]. Apart from that, excessive use of inorganic materials also threatens the environment, including decreasing air, soil and air quality, increasing resistance and resurgence of plant pest organisms, disrupting the balance of biodiversity, and polluting agricultural products [5]. Therefore, a strategy is needed to produce quality agricultural products whose production processes are environmentally friendly and sustainable, and safe for human health Public awareness of healthy lifestyles has led to an increase in demand for organic products [8] including citrus fruit. Although it has not yet been implemented on a wide scale, environmentally friendly orange cultivation has been carried out at the farmer level, including in East Java, Bali, Bengkulu, Lampung and West Java. Several environmentally friendly cultivation techniques that are applied are the use of organic and biological fertilizers and pesticides, integrated pest and disease control, use of organic materials around the garden, and intercropping [8] [10]. The concept of sustainable environmentally friendly agriculture refers to cultivation practices that improve the quality of the environment and agricultural resources in the long term, can be accessed and implemented by farmers, lead to increased productivity and quality of agricultural products, are economically viable, and improve the quality of life of farmers and society as a whole [9][11] [12]. Some agricultural systems included in the above concept are sustainable agriculture with low input (LISA), sustainable agriculture with low external input (LEISA), integrated agriculture, precision agriculture, conservation agriculture, climate-smart agriculture, permaculture, agroforestry, and organic agriculture .

The aim of this research is to use organic fertilizer according to the Leisa method through intercropping patterns of fruit horticultural crops with annual cabbage and Lombok crops. optimally utilize the production factors owned by farmers (including limited land, labor, working capital), use fertilizers and pesticides more efficiently in the hope of reducing erosion, land conservation, biological stability of the soil and getting a greater total production compared to monoculture planting.

THEORETICAL FRAMEWORK

Intercropping is a plant cultivation system where more than one plant is planted in one planting area. This system is used to maximize land function and is expected to increase land productivity and also increase farmer income. Efforts to increase fruit horticulture production are carried out through intensification, extensification and diversification which are carried out in an integrated, harmonious manner and while maintaining the preservation of natural resources and the environment to achieve resilient agricultural conditions [11] Efforts to extensify or expand agricultural land on the decreasing number of productive lands from year to year due to the use of land for non-agricultural purposes, such as for housing, industrial offices and so on. Meanwhile, intensification efforts often experience obstacles, due to the implementation of inappropriate technology packages in the use of chemical fertilizers and pesticides at much higher doses from the recommended dose, which can reduce farming efficiency and cause negative impacts on the environment. The intercropping pattern is the planting of more than one plant at the same time or during the planting period, in the same place. In the intercropping planting pattern, there are principles that must be taken into account, namely: plants planted in intercropping should have different ages or growth periods, have different needs for Environmental factors such as air, humidity, light and plant nutrients have an allelopa influence This dual farming system is very suitable for our farmers with limited land in tropical areas, so that they can maximize production with low external input while minimizing risks and conserving natural resources. Apart from that, there are other advantages of this system:

a. reducing soil erosion or loss of cultivated land
b. improving water management on agricultural land, including increasing the supply (infiltration) of air into the soil so that air reserves for plant growth will be greater. Lots. available
c. fertilize and improve the structure of the soil
d. increase the usability of the land so that farmers' income will also increase
e. be able to save labor
f. avoid seasonal decline because the land can be planted continuously,
g. tillage does not need to be done repeatedly
h. reduces the population of pests and plant diseases
i. enriches the nutrient content of nitrogen and other organic materials.

With this intercropping system, apart from farmers being able to harvest more than once a year with a variety of commodities (yield diversification), the risk of crop failure can also be reduced, crop intensity can increase and utilization of available air, sunlight and nutrient resources will be more efficient. The LEISA system is implemented on the basis of two-way participatory planning and in its implementation continuous active, participatory assistance is carried out as an accelerated evolutionary process. This system can be chosen either as the final terminal for agricultural activities or as a transition system towards further development. This must be based on the condition of the island in terms of its biophysical and socioeconomic components. It is estimated that small numbers can carry out agricultural development not only to increase productivity but also to increase the sustainability function towards agricultural continuity as well as the longing for life between generations. Initially agriculture in tropical areas depended on natural resources, knowledge, skills and local institutions.

METHODS

The place where the research was carried out was in Bayung Gede Village, Kintamani District, Bangli-Bali Regency. Bayung Gede Village is located at an altitude of 950 meters above sea level. Implementation of this research activity will start from january to August 2023

This research activity uses materials including: Siamese orange plants, annual plants namely cabbage plants and Lombok plants as intercropping plants, Siamese orange fruit waste, cow manure, cow urine, sawdust (softwood), while tools used include: hoe, plot, bucket, hoe, weigh, lime, d o l o m i t .

This research used a Randomized Group Design (RAK) with two factors arranged sequentially. The first factor tried was the concentration of the organic waste solution from orange fruit waste (P), namely: 1). Without applying citrus fruit waste fertilizer/POC (P0), 2). P1 (2lt/plant) and P2 (4lt/plant), while the second factor tried was the intercropping pattern (T) which consisted of 3 levels, namely T0 (without intercropping), T1 (intercropping Siamese oranges with cabbage plants), T2 (intercropping Siamese oranges with chili plants), so there were 9 treatment combinations, each repeated 3 times so that 27 Siamese orange plants, cabbage plants and chili plants were needed each. The parameters observed include external quality, namely the number of shoots that grow, the number of flowers that appear, the number of flowers that fall and the number of fruit sets formed. The internal qualities observed included total N content, leaf Clorofol, and leaf KAR. Data obtained The analysis uses the F test. If the results of the F test show that the treatment has a significant effect, then proceed with the BNT test with a confidence level of 95%.

RESULTS

Identification of The Phase of The Flowering Organs of The SIAM Orange Plan The flowering period of Siamese orange plants is marked by morphological characteristics, including: the occurrence of leaf changes, namely: from dark green leaves, then there is a change in the color of transparent light green leaves. This is followed by a change in the appearance of the prospective flowers with signs of swelling on the surface of the leaf buds. Macroscopic identification of the flower development of Siamese orange plants consists of four phases, including: 1) induction phase, visually observing that there are no changes in the shoots or axils of the plant. 2) defrentiation, marked by the beginning of the appearance of flower buds in the pintol-sized leaf axils. 3) Flower buds begin to develop in the pintol-sized leaf axils. 3) flower buds begin to develop on the shoots and 4) flowers begin to bloom

Table 1. Length and diameter of axillary stalks/last internode shoots, quantity

Varia ble	Axillary/bud type Flowering shoots	
	Pucuk berbunga	Shoots do not flower
Length of axillary stalk, last shoot (cm)	2.656	4.468**
Diameter of axillary stalk/last shoot (cm)	0.257	0,149 **
Number of leaves per nag (fruit)	3.162	5.583**
Terminal leaf length (cm)	4.432	7.352**
Terminal Leaf Width (cm)	2.273	4.029**
Leaf dry weight ratio (Grams)	2.268	2.053**

*Note: on the same line, the numbers followed by tn, * and ** mean that they are not significantly different at the 5% level, significantly different and very significantly different at the 1% and 5% levels respectively.*

Table 2. Significance of the effect of treatment on POC concentration (P) and pattern type intercropping (T) and its interaction (PxT) on the observed variables

No	Variab le	Treatment		Intera ction
		Concentration Janis (P) intercropping pattern (T)		
		(P)	(T)	(P x T)
1	Number of young shoots per tree (pieces)	**	**	ns
2	Number of flowers/trees (florets)	**	**	ns
3	*Fruit set* (%)	*	ns	ns
4	Leaf relative air content (%)	**	**	ns
5	*Leaf chlorophyll content (SPAD)*	*	ns	ns
6	Leaf N nutrient content (%)	*	ns	ns
7	Leaf P nutrient content (%)	*	ns	ns
8	Leaf K nutrient content (%)	**	ns	ns

Information:
* = significant effect ($P<0.05$)
** = very significant effect ($P<0.01$)
ns = not significant effect (P □0.05)

Based on the results of statistical analysis of all variables observed in this study, they are presented in Tables 1 to 6. The significance of the influence of POC fertilizer concentration (P) treatment and type of intercropping pattern (T) and their interaction (GxP) on the observed variables is presented in Table 5.2. From the results of the data analysis, it can be seen that the interaction between the concentration of POC liquid organic fertilizer and the type of intercropping plants had an insignificant effect on all parameters observed at the p level of 5%. The concentration of liquid organic fertilizer treatment had a very significant effect on the parameters of the number of young shoots per tree (strands), the number of flowers/ tree (florets), relative water content of leaves (%), total to very significant sugar content of fruit-set formed (%), chlorophyll content of leaves (spad), N content of leaves (%) and P nutrient content ofleaves (%). Growth in the shoot apical meristem (SAM) during the vegetative phase forms a shoot architecture with primordia which then develop into leaves/or shoots or lateral vegetative branches (Bowman and Eshed, 2000). After the transition to generative growth, most or all of the apical meristem forms flowers. Pidkoowich et al., (1999) stated that the development of flower buds differs from the development of vegetative buds in several very dramatic ways, namely:

1. unlike most vegetative buds, flower buds are determinate and growth stops after the final reproductive organs are formed.
2. The initiation and development of lateral tuna is greatly suppressed whenformation of flower buds.
3. The number of arrangements and morphology of flower organs is very specific depending on the species. Specific changes in the apices occur during flowering

Table 3. Average number of young shoots, number of flowers and fruit per tree, in the treatment of POC (P) concentration and type of crop intercropping pattern(T) Siamese orange plant

Treatment	Number of Shoots (strands)	Qty of Interest (florets)	Frit-set Qty (fruit)
Concentration POC (P)			
P0	191,33 b	285,44 c	157,22 c
P1	227,00 a	295,11 b	172,78 b
P2	229,67 a	299,22 b	175,33 b
BNT 5%	8,13	5,48	12,74
intercropping pattern			
T0	198,95 a	265,13 c	89.58 c
T1	212,92 b	295,50 b	157,08 b
T2	225,75 b	303,08 a	188,00 a
BNT 5%	7,04	6,33	15,00

Note: The average value followed by the same letter in the same treatment and column means that it is not significantly different at BNT test level 5%.

Table 4. Average relative leaf air content (%) and leaf chlorophyll content (Spad) in the treatment of POC concentration (P) and plant type (T) intercropping pattern on flowering and fruit-set of Siamese orange plants

Treatment	KAR %	CHLOROPHYL *(SPAD)*
Concentration POC (P)		
P0	0,95 b	52,44 a
P1	0,96 a	52,96 a
P2	0,97 a	53,87 a
BNT 5%	0,02	2,23
intercropping pattern (T)		
T0	0,93 c	50,60 b
T1	0,95 b	53,52 b
T2	0,95 a	53,98 a
BNT 5%	0,01	2,67

Note: The average value followed by the same letter in the same treatment and column means that it is not significantly different at BNT test level 5%.

Table 4. shows that the KAR value for leaves in the treatment with a POC concentration of 4 l/l air per tree (P2), namely 0.97%, is significantly higher than the KAR value for leaves in the treatment without POC concentration/control (P0), namely 0.95%. These data show that giving a POC concentration of 4 liters can improve the status of the plant's air tissue as indicated by increasing leaf KAR, which could be caused by increasing the plant's ability to absorb fruit air and/or reducing transpiration. This condition causes plant metabolic processes due to increased POC concentrations (Table 4). Table 4 shows that the leaf chlorophyll content was significantly higher in the POC concentration treatment of 4 l/l air per tree (P2), namely 51.31 SPAD when compared to the treatment without POC/control concentration (P0) which was only 47.38 SPAD causing a higher photosynthesis process as evidenced by the lower percentage of fallen flowers per tree, namely 6.03% in the POC concentration treatment of 4lt/l air per tree (P2). when compared with treatment without POC concentration reached 8.35%. The low percentage of fallen flowers per tree means that the photosynthesis process is better when given a POC concentration of 4 l/l of air per tree (P2). Apart from that, it also increases the leaf chlorophyll and KAR content and is also supported by increasing the N and K content in plants. tissue of 1.87% and 3.07% compared to the N and K contents obtained in treatment without paclobutrazol (P0), namely only 1.55% and 2.50%

Table 5. Average leaf N, P and K nutrient content (%) in the treatment of POC concentration (P) and plant type intercropping pattern (T) on the flowering and fruiting of Siam orange plants

Treatment	N nutrient content (%)	P nutrient content (%)	K nutrient content (%)
Concentration POC (P)			
P0	1,53 ab	0,16 b	2,68 a
P1	1,88 b	0,16 b	2,49 a
P2	1,94 a	0,18 a	2,82 a
BNT 5%	0,07	0,03	0,52
intercropping pattern (T)			
T0	1,75 b	0,16 b	2,52 b
T1	1,76 b	0,16 b	2,62 b
T2	1,78 b	0,16 b	2,43 b
P3	1,84 a	0,19 a	3,08 b

Note: The average value followed by the same letter in the same treatment and column means that it is not significantly different at BNT test level 5%.

Table 4. showed that the leaf chlorophyll content was much higher in the POC concentration treatment of 4 l/l air per tree (P2), namely 51.31 SPAD when compared to the treatment without POC/control concentration (P0) which was only 47.38 SPAD causing a higher photosynthesis process as evidenced by the lower percentage of fallen flowers per tree, namely 6.03% in the POC concentration treatment of 4lt/l air per tree (P2) . when compared with treatment without POC the concentration reached 8.35%. The low percentage of fallen flowers per tree means that the photosynthesis process is better when given a POC concentration of 4 l/l air per tree (P2). Apart from that, it also increases the chlorophyll and KAR content of leaves and is also supported by increasing the N and K content in plants. tissue of 1.87% and 3.07% compared to the N and K contents obtained in treatment without paclobutrazol (P0), namely only 1.55% and 2.50. 5.5) Leaf P levels also increased in the POC concentration treatment of 4 l/l air per tree (P2), namely 0.20%, although statistically it was not significantly different from no p% (Table 5) POC/control concentration treatment (P0) was only 0.16 %

DISCUSSION

Based on the results of statistical analysis of all variables observed in this study, they are presented in Tables 1 to 6. The significance of the influence of POC fertilizer concentration (P) treatment and type of intercropping pattern (T) and their interaction (GxP) on the observed variables is presented in Table 2.From the results of the data analysis, it can be seen that the interaction between the concentration of POC liquid organic fertilizer and the type of intercropping plants had an insignificant effect on all parameters observed at the p level of 5%. The concentration of liquid organic fertilizer treatment had a very significant effect on the parameters of the number of young shoots per tree (strands), the number of flowers/ tree (florets), relative water content of leaves (%), total to very significant sugar content of fruit-set formed (%), chlorophyll content of leaves (spad), N content of leaves (%) and P nutrient content of leaves (%).

Growth in the shoot apical meristem (SAM) during the vegetative phase forms a shoot architecture with primordia which then develop into leaves/or shoots or lateral vegetative branches (Bowman and Eshed, 2000). After the transition to generative growth, most or all of the apical meristem forms flowers. Pidkoowich et al., (1999) stated that the development of flower buds differs from the development of vegetative buds in several very dramatic ways, namely: (1) unlike most vegetative buds, flower buds are determinate and growth stops after the final reproductive organs are formed. (2). The initiation and development of lateral tuna is greatly suppressed when formation of flower buds. and (3) The number of arrangements and morphology of flower organs is very specific depending on the species. The emergence of shoots on non-flowering shoots, the new shoots grow straight and do not experience enlargement and swelling at the base (Figure 1) while the shoots/armpits that will flower, the base of the new shoots are enlarged and swollen (Figure 3), these are early signs defrentiation occurs or the final stage of flowering induction. In statistical analysis, there was a significant difference ($P<0.05$) between flowering shoots/armpits and non-flowering shoots/axillary in shoot length/last node axil (Cm), shoot stem diameter/last node axil (Cm), The inflorescence of the Siamese orange plant is characterized by morphological characteristics, including: the occurrence of changes in the leaves, namely: from dark green leaves, then changes in the color of the leaves to transparent light green, then followed by changes starting with the appearance of potential flowers with signs of swelling on the surface of the leaf shoots. . The flower development of Siamese orange plants consists of four phases when viewed morphologically, including: 1) induction phase, visually observing that no changes have occurred in the shoots or axils of the plant. 2) defrentiation, marked by the beginning of the appearance of flower buds in the axils3) Flower nipples begin to appear on the shoots and the flowers begin to bloom (Figure 5. Morphology of flower development in Siamese orange plants. Flowering is a determining factor in fruit formation in fruit horticultural plants. The process associated with the Siamese orange plant involves bud initiation followed by flower emergence, and subsequent processes. The highest fruit set % (percentage of the number of flowers becoming fruit) was obtained in the POC concentration treatment of 4 l/l air per tree (P3), namely 53.87%, an increase of 12.32% when compared to the lowest value obtained in the POC concentration treatment of 0 l/l air per tree/control (P0) which is only 52.44% which is significantly different from the POV concentration treatment of 2 l/l air per tree (P1) which is 67.69% and without POC/control concentration (P0) which is 68.93 (Table 3).

CONCLUSIONS AND RECOMMENDATIONS

1. The interaction between the concentration of POC liquid organic fertilizer and the type of intercropping plants had no significant influence on all parameters observed at the p level of 5%.
2. The supporting content for the formation of fruit sets, such as the KAR value of leaves in the POC concentration treatment of 4 l/l air per tree (P2), which is 0.97%, is significantly higher than the KAR value of leaves in the treatment without POC/control concentration (P0), which is 0, 95%.

FURTHER STUDY

The suggestion that needs to be carried out further is to continue to provide POC liquid organic fertilizer treatment by increasing the application dose using a type of intercropping pattern for fruit horticultural crops with seasonal crops such as nuts.

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