Indian Journal of Agricultural Research

Effect of Inorganic Fertilizers and Stingless Bee Pollination on Increasing Productivity of Corn (Zea mays L.)

Dewirman Prima Putra, Murnita, Jasmi

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Effect of Inorganic Fertilizers Optimization of and Stingless Bee Pollination in on Increasing the <u>Products Productivity</u> of Corn (zea-Zea mays I.L.) Authors (Missing?)

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8 ABSTRACT

This study was aims aimed to get the at optimization of the increased production of 9 corn by using optimized dose of inorganic fertilizers and pollination with the help of stingless 10 bees-without the sting. The study was carried out in at Korong Gadang sub-district, Kuranji 11 District, Padang City $(-0^{-0}57 \text{ LS}, 100^{-0}21^{\circ}\text{ BT})$ at an altitude of with a height of 20 m above 12 sea level (dpl.). The experiment used a randomized block design with comprised of _4 13 treatments and 3 replications laid out in randomized block design replicated thrice. The results 14 of the study shows showed positive influence of the contribution amount doses of inorganic 15 fertilizer and stingless bee pollination to the increase inon corn production. The experiment 16 used a randomized block design with 4 treatments and 3 replications. The study was carried 17 out in Korong Gadang sub-district, Kuranji District, Padang City (-0-⁶57 'LS, 100-⁶21' BT) 18 19 with a height of 20 m above sea level (dpl.). There was results showed an increase in corn 20 products per fruitnumber of seeds per cob and cobs and per plot is more dominated by thedue to fertilization paradigm than the pollination paradigmstingless bees. Increased seed 21 production per plot for due to fertilizer use an organic rangeranged between 17.25 to 25.06% 22 compared to organic fertilizermanures. Nevertheless, the The pollination process can could 23 increase the production per plotin the range of 3,98 - 6.66% compared to wind pollination. 24 25 Thus Pollination with Trigona laeviceps can could help seed weight and product yield per ha, but must be when accompanied by the use application of inorganic fertilizers. The use of 26 organic fertilizer manures has not been able to could not meet the nutrients nutrient 27 requirement of the crop so that the production quantity is still and hence production was low. 28 Keywords: Optimization, Fertilization, Pollination, Production, Stingless bee 29

30 INTRODUCTION

Currently, farmers just assume that fertilizer is the only <u>activity-input</u> that contributes to improving agricultural output.<u>,</u> even-Further they believe the that bigger the fertilizer dose they provide then will the higher the production they would earn. They do not know that the role of <u>animals-bees</u> that help the pollination process (pollinators) <u>can-could</u> increase their
 agricultural output<u>crop yield</u>. The<u>y often</u> worst condition is that they think the pollinator is a
 pest <u>for of</u> the plants.

Pollination or pollination is a method of sexual reproduction of plants which is a mechanism of transfer of pollen from anther in male flowers to female flower stigma (Evans and Spivak, 2006; Higo, Rice, Winston and Lewis, *et al.*, 2004). Pollination by pollinators is an important ecosystem service because as 35% of global food supply comes from plants that depend on animal pollination (Klein *et al.*, 2007) and 70% of all fruit and vegetable crops show an increase in the size, quantity, quality, or stability of the harvest when pollinated by bees or other animals (Ricketts *et al.* 2008; Nicholls and Altieri 20-12).

Some research<u>ers results have shown</u> that an increase in both the quality and quantity
of agricultural products <u>due to pollinators</u>. In Kakamega, Kenya, there <u>is was</u> an increase in
results <u>yield ranging</u> between 25% - 99% of various plants with the help of bees as pollinating
insects (*pollinators*) (Kasina, 2007). The results of research on

chili plants<u>, showed</u> an increase in fruit weight yield per plant by 49.75% -66.46% and production per ha by 40.83% -54.26% pollinated by *Trigona* sp (Putra, *et al.*, 2016). In sunflower (*Helianthus annuus*) an increase in seed production-yield of 78.37 % was observed, when compared with plants without access to pollination made by insects (Paiva, 2000).

Corn is a monoecious plant because with male and female flowers are foundobserved in one-the same plant. Corn plants are protandry, wherein most varieties, male flowers appear (anthesis) 1-3 days before female flower hair appears (silking) (Malerbo-Souza *et al.*, -(2008). Therefore, the Corn crop is called mostly cross-pollinated crops, where most of the pollen comes from other plants. Corn plants that only have pollen and do not have nectar, then the arrival of insects only on male flowers. Cross-pollinated pollination always require agent pollinators that carry pollen from one flower to anthera stigma of another flower.

From On the basis of the two paradigms of increasing agricultural products described
the above observations, it is necessary to an experiment was conducted research on to study
the effect of Inorganic inorganic Fertilizers fertilizers Optimization and in combination with
Stingless stingless Bee bee Pollination pollination in Increasing increasing Corn corn Crop
yield (Zea mays L.) This study aims to evaluate whether the fertilizing paradigm makes a
beneficial contribution optimal or the pollination paradigm in corn plants.

65 MATERIALS AND METHODS

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This research has been experiment was carried out in-at_Korong Gadang Sub-District,
 Kuranji District, Padang City (-0⁻⁶57 'LS, 100⁻⁶21' BT) which is included in the considered to

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be lowlands. (20 m dpl), The experiment consisted of 4 treatments viz. P₀ (Fertilizers
 inorganic and pollination by wind, P₁ (Organic fertilizers and pollination by *Trigona*

70 *laeviceps*, P₂ (Inorganic fertilizers and pollination by *Trigona laeviceps*, P₃ (inorganic

71 fertilizers and pollination by other pollinators laid out in randomized block design (RBD)

72 replicated thrice. The sowing was done on

73 **Research Implementation**

Plant maintenance begins with a raised bed <u>of</u> length 350 cm, width 50 cm and a
height of 20 cm with the distance between beds 50 cm. Each treatment consisted of four plots,
with <u>at</u> a spacing of 75 x 25 cm <u>on a bed size of</u> <u>and one hole for one plant</u>. The beds are
locked in a waring where the confinement is made in the size of 4m x 4m-x 3m. Single doses
dose of N, P, and K fertilizer used were 350 kg urea, 175 kg SP 36single super phosphate, and
100 kg KCl-potassium chloride / ha was applied at the time of sowing.

80 Experimental design and data analysis

81 The experimental design used in this study is a Randomized Block Design (RAK), 82 with 4 treatments and 3 replications where treatment: P_0 (Fertilizers inorganic and pollination 83 by wind, P_{\perp} (Organic fertilizers and pollination by *Trigona laeviceps*, P_2 (Inorganic fertilizers 84 and pollination by *Trigona laeviceps*, P_3 (inorganic fertilizers and pollination by other 85 pollinators. Observations were recorded on parameters consisted of cob length, ear cob 86 diameter, number of combs, weight per of earcob, the weight of 100 seeds, and production 87 seed yield per plot.

The data <u>obtained_recorded</u> were analyzed using analysis of variance (ANOVA) <u>techninque</u> and <u>if-when</u> $F_{hit} > F_{tab}$ 5%, then <u>continued</u>-Duncan <u>New-</u>Multiple Range Test (DNMRT) <u>testswas carried out to to check the statistical superiority of the treatments</u>. Data analysis was performed using SPSS 16 statistical software.

92 **RESULTS AND DISCUSSION**

93 Cob length, <u>Con-Cob</u> diameter, and <u>amount-number</u> of combs

94 The average length of cob, cob diameter and a lotnumber of corn_combs with various 95 fertilizing and pollination treatments are presented in Table 1. The results showed that the length of the cob and the manynumber of combs per plot recorded with of the P₁ treatment 96 were significantly different lower as compared to from the treatments of P0, P2, and P3, and 97 98 Po_treatment, P2 and P3 did not differ markedly significantly with _not each other. Treatment eCob diameter in P₀ no was significant effectat par with treatment P₂ and P₃, but was 99 significantly different as compared to P_1 treatments. P_1 and P_2 were at par with each other. 100 treatment is similar to the treatment of P₂ 101

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102 Significantly Significant differences in cob length, ear-cob diameter and 103 number of combs per plot were observed in treatment P_1 with treatments as compared to P_0 . P₂ and P_{3-, this} <u>This is may be</u> due to the treatment P₄ the fact that fertilizer used is organic 104 fertilizer used in that treatment, whereas in other treatments the fertilizer used is inorganic 105 106 fertilizer was used. Although Nnutrient content of organic fertilizer, although complete 107 comprises both macro and micro elements, the percentage is very low. Hartatik and Widowati 108 (2010), reported that nutrient the content of N, P and $K_{\overline{1}}$ in cow manure was, respectively 109 1.53%, 0.67%, and 0.70%.-%, respectively. Besides that, its-the nutrient availability as plant nutrients in the soil, especially P is slowly available also slow. especially P nutrients. The P 110 has a role of the P element-in flower formation influences the formation and size of cob 111 112 because theas cob is the development of female flowers. Therefore the formation of cobs did not develop optimally. Kuswandi (2007) reports-reported that P is necessary to encourage the 113 formation of flowers and fruit₁₅ it is necessary to have P. element. Thus, in corn plants, the 114 formation of maximum more number of cobs is very necessary forneeds balanced 115 fertilization. Iskandar (2010) explains explained that the use of a balanced inorganic fertilizer 116 117 can-could increase the growth and product-yield of corn. and can provide high levels of corncob production. 118

Increased production seed -yield of corn by inorganic fertilization treatment ranged 119 120 from 17_{7} .25-25.06% as compared to organic fertilizers. In the treatment of Although P₁ 121 although the pollution is was assisted with T. Laeviceps pollination, and the application of organic fertilizer, recorded the lowest production, this is may be due to the lower 122 length and -of the cob, the diameter of the cob and besides fewer the smallest-number of 123 combs. Pollination on thein corn crop to the tune of 95% of the pollination process comes is 124 due to from the pollens from of other plants. Therefore, with the help of the wind can help 125 126 the pollination (Paliwal, 2000).

Weight per cobCob weight, Weight of 100 seed weights and Product Seed yield per plot, 127 128 Average weight per-of_cob, 100 seeds seed weight and product seed yield per plot with 129 various fertilization and pollination treatments are presented in Table 2. The results showed that P_1 treatment showed-recorded the lowest weight per-of cob, the weight of 100 seeds and 130 products-yield per plot were lowest and were significantly different from as compared to other 131 132 treatments. P₃ treatment (another pollinator) provides recorded the highest results values of the observation parameter weight per plotweight of cob, the weight of 100 seeds and product 133 seed vield per plot. 134

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The fertilizer application assisted by along with pollinator *T. laeviceps* and other pollinators_ean_could_increase the weight per-of_cob, west-weight_100 seeds, and product seed yield per plot. This can_could_be seen-observed in the treatments P_2 and P_3 which are were significantly different from the higher as compared to treatment $P_0 P_0$ where (pollination was with the help of wind) alone. Increased production_corn yield due toby *T. laeviceps* and other pollinator ranged from 3, 98–6.66% as compared to wind pollination.

Di-Giovanni *et al.*; (1-995) explained, because reported that the size of corn pollen is large and heavy, the ability of the wind to fly pollen is not too far away. Therefore pollinator services are needed. However, because as pollinator access to visit to flowers is not very relevant common (there is no nectar in corn), pollinator assistance to help the pollination process does not work as it should.

Insects, such as bees, have been observed to collect pollen from corn tufts, but they do
not play an important role in cross-pollination because as there is no incentive to visit female
flowers (Ray-n-or *et al.*, 1972,).-, Added by Silveira-Neto *et al.*, (1976):-, and Wiese, 2000).
Only bees of *A. mellifera* species that constantly visit the male flowers of corn plants (86.11%
- 100%).

151 CONCLUSION

152 Fertilization Application of inorganic fertilizer in corn is given mainly inorganic 153 fertilizers, where there is recorded an increase in cob length, ear-cob diameter, number of 154 combs, weight per-of ear-cob and an-increase in the product of seed yield ranging $17_{27}25$ -155 25.06% as compared to organic fertilizer. The role of pollinators to help the process of in 156 pollination in Corn-corn is not very relevant. Increased corn crop production due to the help of 157 *T. laeviceps* pollinator and other pollinators ranged from $3_{27}98$ -6.66% compared to wind 158 pollination.

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212 213	Table 1. Average leng treatments	gth of tongko, diameter	of cob and number of	corn combs with various	
215	I <u></u>	Lana	Diameter	amountNo. of	
	Treatment	Long Cob <u>Lenght</u> (cm)	Cob <u>diameter</u> (cm)	Comb <u>s/</u> (row)	Formatted: English (U.S.)
	P ₀	16.23 ^a	5.35 ^a	15.78 ^a	Formatted: English (U.S.)
	P_1	14,470 ^b	5.08 ^b	14,67 ^b	
	P 2	16.38 ^a	5,21 ^{a b}	15.78 ^a	
	P ₃	16.85 ^a	5,31 ^a	16.22 ^a	
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217	fertilizer and pollination	on by other pollinators)			
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220	Treatment				
	Treatment	Weight per of	100 <u>seed</u> weight	Weight perSeed	Formatted: English (U.S.)
	l	Cob (g)	Seed Grain (g)	<u>yield per</u> Plot (kg)	Formatted: English (U.S.)
	P _{eq}	261.89 ^b	33.30 °	9,910 °	Formatted: English (U.S.)
	P_1	223.35 °	31.27 ^d	8,690 ^d	
	\mathbf{P}_{2}	264.20 ^b	34.73 ^b	11,540 ^b	
	1 2	204.20	51.75	11,510	

 $\frac{P_3}{a, b, c, d} \frac{279.33}{a} \frac{38.48}{38.48} \frac{11,540}{210,00} \frac{11,540}{a}$

- 222 P_O (Inorganic fertilizer and wind pollination), P₁ (Organic fertilizer and pollination by *Trigona*
- 223 laeviceps, P₂ (Inorganic fertilizer and pollination by Trigona laeviceps, P₃ (Inorganic fertilizer
- and pollination by other pollinators).

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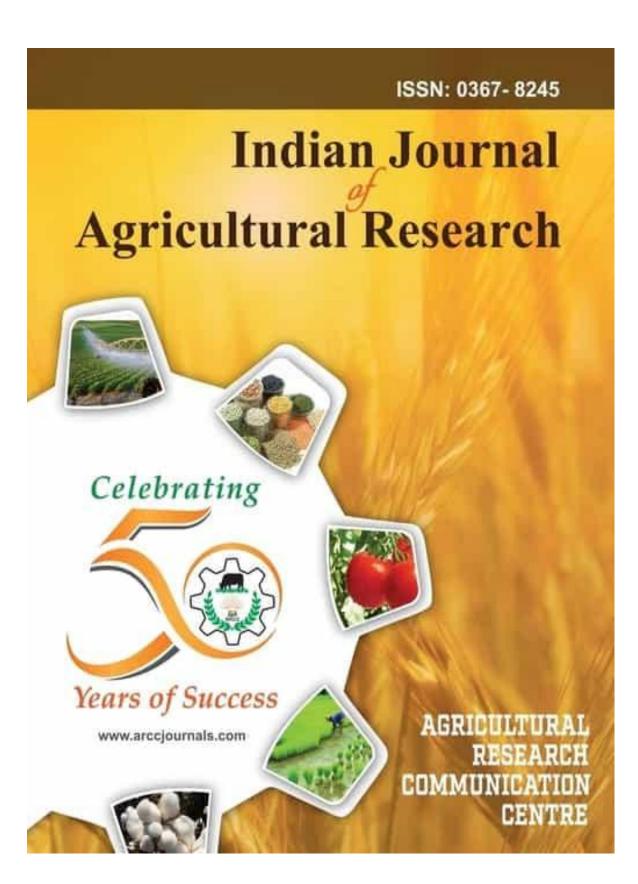
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