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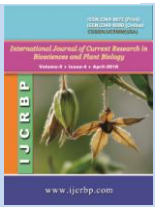

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Characterization, Identification, and Analysis of Plant Growth Regulator (PGR) Conditions to Four Types of Free Clean Maize

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ABSTRACT

The high price of chemical fertilizers and residues in the soil, resulting in low production of food and vegetables, biological fertilizer is believed to be able to improve and improve the availability of nutrients in the soil by utilizing existing compounds in plants in the form of PGR. Plants in general have the potential to produce various compounds, one of which is in the form of "natural PGR". The issue now is that PGR is naturally environmentally friendly. Eco-friendly agriculture uses a lot of natural PGR. However, natural PGR is still very limited. This study aims to obtain PGR content from sweet corn, pulut corn, yellow corn, and white corn. The results showed that the highest content of auxin (IAA) was found in sweet corn PGR of 27.9303 ppm and the lowest was yellow corn PGR of 2.2689 ppm. The highest gibberellin content is found in sweet corn PGR of 442.8318 ppm and the lowest is yellow corn PGR of 74,0705 ppm. The highest content of cytokines (kinetin) is found in pulut corn PGR of 45.8963 ppm and the lowest is yellow corn PGR of 33.5830 ppm.

Introduction

One role of plant hormones is to influence flowering initiation by regulating the balance between carbohydrates and nitrogen (C / N ratio). Excess supply of nutrients (carbohydrates) in plants will stimulate the flowering. Arika et al. (2009) states that gibberellin is able to increase the C / N ratio. The higher the C / N ratio, the plant will undergo a transition from the vegetative to the reproductive. This leads to faster flower initiation time.Giberelin is able to accelerate flowering of plants through the activation of flower meristem genes by producing proteins that will induce the expression of flowering organ genes (such as corolla, kalix, stamen, and pistillum) (Arika et al., 2009). Auxin is one of the plant hormones that can regulate many physiological processes, such as growth, cleavage and cell differentiation and protein synthesis (Darnell et al., 1986).

Increased cytokinin concentration in leaves is one of the important hormonal phenomena for flower induction. Ryugo (1990) states that the application

of cytokinin on the surface of the cut thread can increase the percentage of the flower buds. Based on this suspected ZPT has an important role in spurring the emergence of flowers, especially hermaphrodites on Jatropha curcas.Applications of growth regulators in modern agriculture include securing yields, increasing size and improving product quality (e.g. in seedless watermelon technology), or uniform flowering time (e.g. in ethylene applications for uniform flowering of seasonal fruits) (Supriyanto and Kaka, 2011). So far known to a number of classes of substances considered as phytohormones, namely auxin, cytokinin, giberilin or gibberellic acid (GA), ethylene, abscisic acid (ABA), jasmonic acid, steroids (brasinosteroids), salicylates and polyamines (Rochimi, 2008).

The growth regulator is a non-nutrient organic compound which in low concentration can encourage, inhibit or qualitatively change the growth and development of plants (Widyastuti and Tjokrokusumo, 2001 *in* Amraini and Sugiyanta, 2008). PGR applications in plants can influence the transport of assimilates, complementary senensen and cell enlargement (Wattimena, 1988 in Amraini and Sugiyanta, 2008). The effect of PGR application on a plant will be obvious if the condition is healthy, the nutrients are met and.Auxins play a role in growth to spur the process of cell lengthening (Zhao, 2008, Zhao, 2010; Bajguz and Piotrowska, 2009) the formation of lateral roots and root fibers causing the absorption of air and minerals can run optimally. Cytokinin is a hormone that plays a role in cell division (cytokinesis) (Zhao, 2008; Zhao, 2010; Kyozuka, 2007; Bajguz and Piotrowska, 2009).

The function of cytokines is to stimulate the formation of roots and stems and the formation of root branches by inhibiting apical dominance, regulating the growth of leaves and shoots, and inhibiting the aging process by stimulating the process as well as transporting mineral and amino acid salts to the leaves (Taiz and Zeiger, 2002; Kyozuka, 2007; Raffaele, 2008; Bajguz and Piotrowska, 2009). According to Karadeniz et al., (2006); Samse and Tiurmaida, (2006) Giberelin function in the process of seed formation, which stimulates the formation of pollen (pollen), enlarge the size of the fruit, stimulate the formation of flowers, and end the dormancy period. Giberelin with low concentrations does not stimulate root formation, but at high concentrations will stimulate root formation (Jauhar et al., 2013).

Growth and development of plants progresses continuously throughout the life cycle, depending on the availability of meristems, assimilation products, hormones and other growth substances and a supportive environment (Gardner et al., 1991). In this regard various efforts have been made in the effort to increase the growth and production of plants, both the method of cultivation, as well as the addition of various substances of growth. One is the use of growth hormones to increase plant growth and production. Plants naturally already contain growth hormone called endogenous hormone. However, this hormone is less optimum affect the process of vegetative growth and reproductive plants. The addition of Plant Growing Regulators (PGR) is often done to optimize vegetative and reproductive growth of crops, eg gibberellin (GA) capable of accelerating growth and flowering (Abidin 1985 *in* Siti Komariyah et al., 2012).

Plants in general have the potential to produce various compounds, one of which is in the form of "Hormone". The current issue is the environmentally friendly hormone (Jauhar *et al.*, 2013). Eco-friendly agriculture uses a lot of natural hormones. However, natural hormones are still very limited. This study aims to obtain the content of the Plant Growing Regulatory (PGR) of various types of corn free plants.

Materials and Methods

Place and time

The experiment was conducted at Field Trial of STIP Prima Sengkang, Laboratory of STIP Prima Sengkang, and Laboratory of SUA of Service

Business and Industry, Biofuture. Dep. Biology, FMIPA-IPB. Its implementation time starts from June 2016 until April 2017.

Materials and tools

The materials used in this study were the seeds of sweet corn crop varieties SD3-IPB, corn pulut varieties Pulut Uri, yellow varieties Lamuru maize, and white varieties Srikandi White-1 variety, aquades, molasses, EM4, Urea fertilizer, NPK Mutiara fertilizer, and Organic Fertilizer (fertilizer given according to recommendation of KATAM, BPPP, 2016). The tools used were blender, plastic bucket with size 2 cover, electric scales, strainer, 10-liter jerry can, rubber binder, 1 m clear plastic, plastic mouthpiece / funnel, separating funnel, aluminum foil, evaporator, spectrophotometer, roll meter, hoe, hand tractor mini (making bed), semi automatic knapsack sprayer, Dinamao water pump, Electricity PLN, Sprinkler, tablespoon / tea, measuring cups (size 2 liters), Erlenmeyer flask (2 liters), sickles, machetes, hoes, labels, cameras, and stationery. The data analysis used was descriptive statistic analysis based on data of analysis result done in Laboratory of SUA of Business Service and Industry, Biofuture, Dep. Biology, FMIPA-IPB.

Implementation stages

The first stage was the preparation of the land covering the processing, making the beds, and planting four types of corn, namely sweet corn varieties SD3-IPB, corn pulut Ury varieties, yellow varieties Lamuru corn, and white varieties Srikandi White-1 variety. The second stage was to make PGR extract using sweet corn, corn, yellow corn, and white corn (Diptan, 2016; Heru, 2012; Protected, 2015; Herusidik, 2014, Ulfa, 2014). The place of preparation of PGR extract was at STIP Laboratory of Puangrimaggalatung Sengkang, conducted on the 8th of 2016. Materials used include: 3 kg of sweet corn seeds, 3 kg of corn pulut seeds, 3 kg of seeds of yellow corn, 3 kg of maize seeds white, 15 liters of aquades, 3 liters of molasses, 1.5 liters of EM4. And the tools used are: blender, plastic bucket which has size 2 cover (15-20 liters of water), electric scales, strainer, 15-20 liters jerry can, rubber fastener, 1 m clear plastic, plastic mouthpiece / funnel, Erlenmeyer Pump (1 liter size), tablespoons / teas, labels, cameras, and stationery.

The process of making PGR extract was to take each 3 kg of corn seeds in the milk ripe seed phase which was marked when pressed with nails would release a white liquid like milk, for sweet corn (estimated age 65-70 days after planting), yellow maize (estimated age 60- 65 days after planting), corn pulut (estimated age 60-65 days after planting), and white maize (estimated age 65-70 days after planting) (USDA, 2016; Musa et al., 2014). Corn seeds that have been taken in the Field of Experiments STIP Puangrimaggalatung Sengkang, Wajo Regency and then put each of the PGR extract ingredients into a blender (four blenders), then each blender was inserted into a bucket (four buckets) containing 60 liters of aquades (4 × 15 liters of aquadest), 12 liters of molasses (4 × 3 liters of sugar cane), 6 liters EM4 (4 × 1.5 liters EM4), then the mixture was stirred until smooth, then the plastic bucket was covered and tied with rubber (plastic loosened, so the lid does not break during the fermentation process) stored and placed in a shade / dark (not subject to sunlight), left for 15 days (Ulfa, 2014).

Every morning the lid was opened and the material was stirred, then closed again, filtered the materials to separate the liquid zpt and the dregs, then stored in a sealed container. PGR was ready for use in the form of "Biang" as much as 15 liters (Diptan, 2016; Heru, 2012; Protected, 2015; Herusidik, 2014) (Fig. 1). The third stage was the finished PGR then taken each 250 ml to be analyzed for its contents in the Laboratory of SUA Business Services and Industry, Biofuture, Dep. Biology, FMIPA-IPB. The analysis process began with a 24-hour extract separation process wrapped in aluminum foil. Next it was taken into the evaporator process. The analysis results were seen on the UV-VIS Spectrophotometric display. The method of PGR analysis adopted was from Unyayar et al. (1996).

Results and discussion

The results of the analysis that has been carried out in the Laboratory SUA Business Services and Industry, Biofuture. Dep. Biology, FMIPA-IPB Bogor to four types of PGR from free-ranged maize plants, showed different results in terms of PGR content possessed by all four free-radical maize plants. The results of PGR content analysis of the four corn free crops as follows (Fig. 2).

PGR from sweet corn has auxin content in the form of IAA (27.9303 ppm); gibberellin (442.8318 ppm); and cytokines in the form of Kinetin (34.5724 ppm). PGR from pulut corn has auxin content in the form of IAA (8.9201 ppm); Giberelin (140.9394 ppm); and cytokines in the form of kinetin (45.8963 ppm). PGR from yellow corn has auxin content in the form of IAA (2.2689 ppm); Gibberellin (74.0705 ppm); and cytokines in the form of kinetin (33.5830 ppm). PGR from white corn has auxin content in the form of IAA (18.3866 ppm); Giberelin (398.9600 ppm); and cytokines in the form of kinetin (41.1185 ppm).

Based on the results of the analysis of PGR content of four types of corn-free crops turned out all have different auksin (IAA), gibberellin, and cytokinin (kinetin) contents.The highest content of auxin (IAA) was found in sweet corn PGR of 27.9303 ppm and the lowest was yellow corn PGR of 2.2689 ppm.Auxins play a role in growth to spur the process of cell lengthening (Zhao, 2008; Zhao, 2010; Bajguz and Piotrowska, 2009) the formation of lateral roots and root fibers causes the absorption of water and minerals to run optimally. Auxin is one of the plant hormones that can regulate many physiological processes, such as growth, cleavage and cell differentiation and protein synthesis (Darnell et al., 1986).

Fig. 1: Activity of the second stage of PGR making process to move the PGR into the jeregen, and PGR's packaged and ready for use.

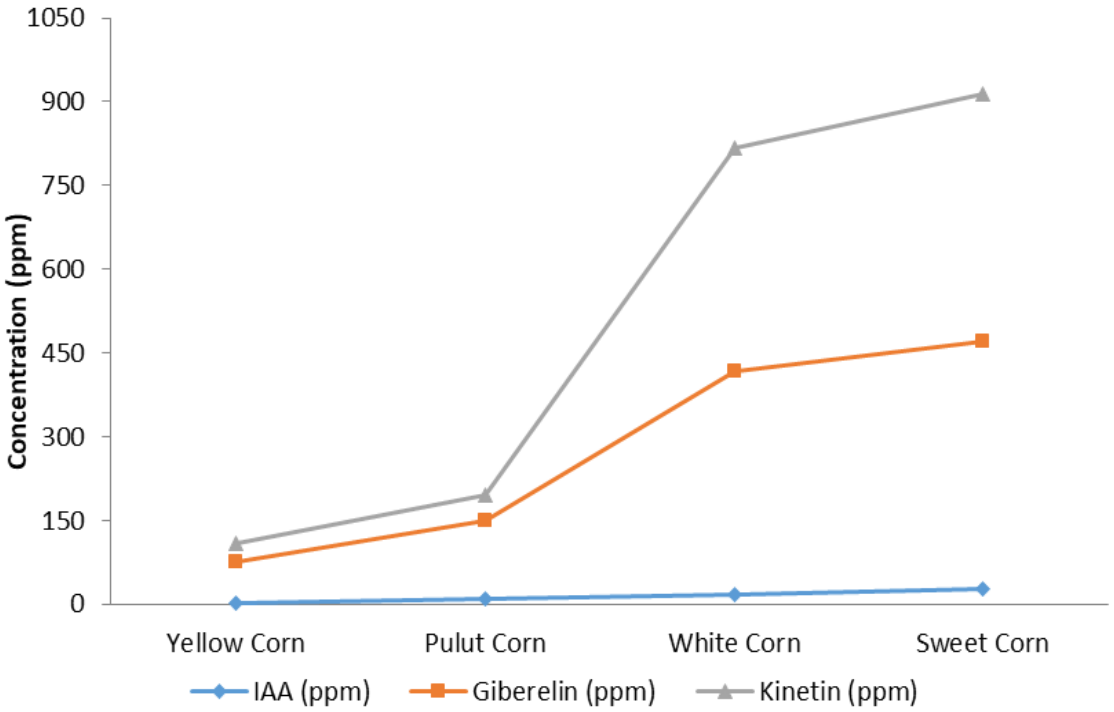

Fig. 2: Results of PGR content analysis of the four types of free-ranged maize at the Laboratory of SUA Business Services and Industry, Biofuture, Dept. of Biology, FMIPA-IPB.

Table 1. Comparative data of ZPT content analysis of results with the method of Unyayar et al. (1996).

Material	PGR (ppm)			Source
	IAA	GA3	Kinetin	
Jatropha Leaves	5.47	5.52	0.001	Siti Komariyah (2012)
Sweet Corn Seeds	1.67	41.23	53.94	Ulfa (2014)
White Corn Seeds	18.39	398.97	41.12	Present study
Sweet Corn Seeds	27.93	442.83	34.57	Present study

The highest gibberellin content is found in sweet corn PGR of 442.8318 ppm and the lowest is yellow corn PGR of 74.0705 ppm.

Giberelin is able to accelerate flowering of plants through the activation of flower meristem genes by producing proteins that will induce the expression of flowering organ genes (such as corolla, kalix, stamen, and pistillum) (Arika et al., 2009).

The highest content of cytokines (kinetin) is found in PGR of corn pulut 45.8963 ppm and the lowest is yellow corn PGR of 33.5830 ppm. Cytokines are hormones that play a role in cell division (cytokinesis) (Zhao, 2008; Zhao, 2010; Kyozuka, 2007; Bajguz and Piotrowska, 2009).

Kinetin is a PGR that promotes cleavage (cytokinesis), commonly present in root ends and meristem areas that undergo rapid cell division, as well as in developing regions (Prawitasari et al., 2002). The results of Siti Komariyah (2012), that spraying auksin and giberelin against andromonoecious plants can increase endogenous auxin and gibberellin content. And spraying kinetin on the jatropha and the cromicoecious can increase the number of inflorescence branches of flowers.

The results of Ulfa (2014), it can be said that the author's PGR content can be generally much higher than the two researchers above, so it is possible to apply to plants for can produce optimal production (Table 1).

Based on the results and discussion, it can be concluded as follows (a). The highest auxin (IAA) and gibberellin content are found in Sweet Corn PGR, (b). The highest content of cytokines (kinetin) is found in corn pulp PGR, and (c). The lowest PGR content found in yellow corn PGR.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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