EFFECTS OF GIBBERELLIC ACID ON GROWTH AND MORPHOLOGICAL VARIATION OF THREE KENAF (Hibiscus cannabinus L.) VARIETIES

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By

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ABSTRACT

Kenaf (*Hibiscus cannabinus* L.), is one of the potential source to fulfil the demand of natural fibres for bio-composite and pulp and papers industry. However, due to the average fibre length of kenaf is below the critical length for bio-composite manufacturing, there is a need to improve its fibre's length and quality. Kenaf plant elongation and improvement of fibre quality can be achieved by the use of plant growth regulators. Gibberellic acid (GA) is a plant hormone that can stimulate growth and development of plant. Therefore, this study is carried out to determine the effects of exogenous application of gibberellic acid on growth and morphological variations of three kenaf varieties which were V36, New Hybrid 2 and Fuhangyou No.2. These varieties were treated with two concentrations of gibberellins (0.0 and 2.0 mL/L). The effects of GA were observed for 16 weeks and the vegetative growth and morphological changes were assessed. The results found that gibberellic acid significantly increased the total height and basal diameter of kenaf, but failed to increase the leaf area and biomass in all kenaf varieties. GA also affected flowering behavior of kenaf varieties and seed production, where all the kenaf varieties treated with 2.0 mL/L concentration did not initiate any flowering. From this study, it can be concluded that GA provided significant effects on vegetative and reproductive growth of kenaf.

ABSTRAK

Kenaf (*Hibiscus cannabinus* L.), merupakan salah satu sumber yang berpotensi untuk memenuhi permintaan gentian semulajadi bagi industri bio-komposit dan pulpa dan kertas. Walau bagaimanapun, disebabkan panjang gentian kenaf adalah di bawah panjang kritikal untuk pembuatan bio-komposit, terdapat keperluan untuk meningkatkan panjang dan kualiti gentiannya. Pemanjangan tumbuhan kenaf dan penambahbaikan kualiti gentian boleh dicapai dengan menggunakan pengatur pertumbuhan tumbuhan. Asid gibberellik (GA) adalah hormon tumbuhan yang boleh merangsang pertumbuhan dan perkembangan tumbuhan. Oleh itu, kajian ini dijalankan untuk mengenalpasti kesan aplikasi luaran asid gibberellik pada pertumbuhan dan variasi morfologi tiga varieti kenaf iaitu V36, New Hybrid 2 dan Fuhangyou No.2. Varieti ini dirawat dengan dua kepekatan gibberellin (0.0 dan 2.0 mL / L). Kesan GA diperhatikan selama 16 minggu dan pertumbuhan vegetatif dan perubahan morfologi dinilai. Hasilnya mendapati bahawa asid gibberellik dapat meningkatkan tinggi keseluruhan dan diameter kenaf, tetapi gagal meningkatkan luas permukaan daun dan biomas dalam semua varieti kenaf. GA juga mempengaruhi pembungaan kenaf dan pengeluaran benih, di mana semua jenis kenaf yang dirawat dengan kepekatan 2.0 mL / L tidak memulakan sebarang pembungaan. Dari kajian ini, dapat disimpulkan bahawa GA memberikan kesan yang signifikan terhadap pertumbuhan vegetatif dan pembiakan kenaf.

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APPROVAL SHEET

I certify that this research project report entitled “Effects of Gibberellic Acid on Growth and Morphological Variation of Three Kenaf (*Hibiscus Cannabinus* L.) Varieties” by Priscilla Tony Conrad has been examined and approved as a partial fulfilment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Univeristi Putra Malaysia.

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cm	centimetre
FH2	Fuhangyou No. 2
GA	gibberellic acid
mm	millimetre
mL/L	millilitre per litre
NH2	New Hybrid 2

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Kenaf (*Hibiscus cannabinus* L.) is a multipurpose fast growing crop that has gained great interest as a potential source of low cost natural fibre and feedstock for energy production. Kenaf fibres has been used as a cordage crop to produce twine, rope and sackcloth for more than six thousand years ago. As fibrous crop, kenaf appears to have the possibility to become a valuable biomass crop of the future and, more recently as raw product for pulp and paper production.

Today, there are increasingly growing demands for natural fibre from woody plants to substitute insufficient supply for forest species. The increased in demand has subsequently decreased the biodiversity and cause many environmental impacts. In addition, paper consumption which was estimated to have increased globally from 300 million tonnes in 1998 to 425 million tonnes in 2010 (Rowell & Cook, 1998; Labidi et al., 2008; Withanage et al., 2015) has created a worldwide shortage of trees in many areas especially for woody fibre resources. Thus, to encounter the issues of increasing demand for natural fibre resources and rapidly diminishing of forest resources, it is necessary to identify a non-wood crop that can fulfill the requirement for raw material from which paper and other products can be produced without causing destruction to forests and the environment.

Kenaf has been identified as one of the world's most potential sources to fulfil this demand without cutting the forests. It is now growing rapidly as a new commodity crop that is gaining a lot of interest due to its multipurpose uses. It also has high potential to be used as industrial crop because it contains higher fibre materials and lignocellulosic material (Hossain et al., 2011; Manzanares et al., 1996). The stalk of this plant consists of 40% outer fibre bast and 60% inner fibre core for which the refined fibres are compatible for many products such as engineering wood, insulator and clothing-grade clothes, security notes, bullet proof jacket, helmets as well as packing materials (Withanage et al., 2015).

Therefore, the success of these industries would depend on improved planting materials especially in terms of yield and quality. Gibberellic acid (GA) is an important plant hormone which has broad spectrum of effects on plant growth, elongation, flowering, development, seed formation and germination (Withanage et al., 2015; Hedden & Thomas, 2012; Mutasa-Gottgens & Hedden, 2009; Fleet & Sun, 2005; Davies, 2004; Schomburg et al., 2003;). Hence, hormonal GA application on the kenaf might provide results and information on actual functional role of GA from this study which is important for better understanding on requirement for breeding of improved varieties of kenaf.

1.2 Justification

Due to global demand for fibrous material, shortage of trees in many areas and environmental awareness, non-wood has become one of the important alternative sources of fibrous material today. There are many varieties of non-wood plant fibres that can be used for papermaking (Hossain et al., 2011; Sabharwal et al., 1994). Some of the non-woods are bagasse, wheat and rice straws and kenaf are being used in pulp and paper production all over the world (Atchison 1996; Hossain et al. 2011).

Kenaf has been identified as a potential crop with many uses. Its stem fibres (either derived from bark and core) are excellent source for fabrics, building materials (particleboards, low-density panels, paper backing and furniture underlays.) bedding material and oil absorbent. In addition, the fibres of this plant are largely used in many manufacturing industries. Thus, it is important to make sure that kenaf can be produced sustainably and with high fibre quality.

From many researches, scientist reported that the genetic variation of a plant plays a significant role in the existence of cell variation and tissue size, composition and distribution. Hence, environmental manipulation or genetic modification is believed to help in elongation of kenaf plant and its fibre. Gibberellic acid (GA), a plant hormone that can stimulate plant growth and development is used in this study to determine the effects of hormonal application as well as the morphological variations on three kenaf varieties.

1.3 Objective

The objective of this study was to determine the effects of exogenous application of gibberellic acid on growth and morphological variations of three kenaf (*Hibiscus cannabinus* L.) varieties.

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