

I. INTRODUCTION

1.1 Background

Kale (*Brassica oleracea* L.var *acephala*) is a leafy vegetable that belongs to family Brassicaceae. Kale is often on the list of super food due to its high nutritional content and multiple health benefits. Kale high in minerals, vitamins, prebiotic carbohydrates, fiber, and protein. Kale contains prebiotic carbohydrates and the phytochemical glucosinolate, which may prevent obesity and cancer (Thavarajah *et al.*, 2016). Kale production needs to be optimize to fulfill the growing demand. In order to achieve higher yield, growth and nutritional qualities, biostimulants are applied to vegetables (Sharma *et al.*, 2016).

Researchers put high attention to biostimulant as an eco-friendly way to improve agricultural sustainability and in crop quality and quantity. Biostimulant are substances or microorganisms aside from fertilizers that applied to plants in specific formulations and have positively impact on growth, development, or stress response of plant (Halpern *et al.*, 2015). Humic fulvic acids, protein hydrolysates and other nitrogen-containing compounds, seaweed and botanical extracts, beneficial fungi and bacteria, chitosan and other biopolymers, and inorganic compounds are all categories of plant biostimulants (Ertani *et al.*, 2013; Du Jardin, 2015).

Application of bio-based products (such as plants, seaweed, and crop residues) may be a potential solution to improving plant growth quality and quantity at low doses (Ertani *et al.*, 2013). Plant extract contains organic compounds such as plant hormones, polyphenols, amino acids, and vitamins, as well as micro and macro nutrients that

could be used as a biostimulant source (Godlewska *et al.*, 2021). Secondary metabolites found in plants include flavonoids, phenolics, alkaloids, and terpenoids, and their derivatives can stimulate plant growth (Du Jurdin, 2015). The plant that has been proven to be a source of biostimulants is moringa extract (Culver *et al.*, 2012). The other plant that proven as biostimulant sources is *Centella asiatica* (Zakiah *et al.*, 2017), garlic (*Allium sativum*) (Mohamed *et al.*, 2020), *Glycyrrhiza glabra* root (Thanna *et al.*, 2016), *Borago officinalis* (Bulgari *et al.*, 2017) and *Lantana camara* (Ganagi & Jagadeesh, 2018).

In the application of biostimulants, concentration of the extract is crucial. Each plant gave different effects depend on the concentration and variety of treated plants. The foliar application plant extracts with distilled water 3% each of sorghum, brassica, sunflower and moringa improve water-used efficiency and transpiration efficiency due to foliage applied plant extracts, better stay-green character, stress tolerance of wheat (*Triticum aestivum*) (Farooq *et al.*, 2017). Foliar application of 3% Moringa leaf extract with water as a solvent can increase the chlorophyll content of *Cucurbita pepo* L. leaves by 34.6% compared to controls (Abd El-Mageed *et al.*, 2017). In addition, Thanaa *et al.*, (2017), recommends that moringa extract with distilled water with concentration of 6% by spraying directly into plant leaves using a hand sprayer after transplanting with an amount of 25 mL can increase growth of plum trees is best result.

Purslane is a plant that has potential as a source of biostimulants because it contains important organic compounds that can stimulate plant growth. Purslane contains 37 metabolic compounds, including 7 organic acids, 15 amino acids, 11 sugars, 3 sugar alcohols, and urea, according to research. Purslane also contains high

levels of amino acids such as lysine, tryptophan, threonine, tyrosine, methionin, phenylalanine, alanine, proline, and glycine (Jin *et al.*, 2016). Based on laboratory tests the secondary metabolites contain in purslane are flavonoids, phenols, alkaloids, terpenoid, steroid, and saponin. Purslane is also rich in mineral nutrients such as nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), natrium (Na), cuprum (Cu), zinc (Zn), iron (Fe), alumunium (Al), manganese (Mn), boron (B).

Considering this background, purslane has the potential to act as a biostimulant on the growth of kale. Therefore, this research concern on how is the effect of four concentration with control of purslane extract application on growth of kale.

1.2 Problem

The problem of this research is:

How is the effect of the application of some concentration of purslane (*Portulaca oleracea* L.) extract on growth of kale (*Brassica oleracea* L.var *acephala*)?

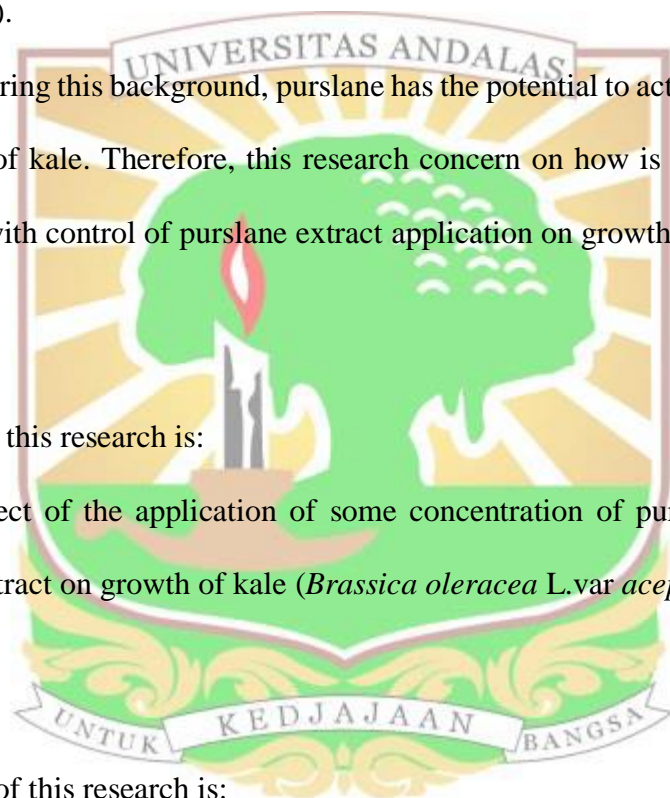
1.3 Objective

The objectives of this research is:

To analysis the effect of some concentration of purslane (*Portulaca oleracea* L.) extract on growth of kale (*Brassica oleracea* L.var *acephala*)

1.4 Research Benefits

The benefits of this research is:



1. To give contribution to the development of science about the potential of *Portulaca oleracea* L. extract as the new source of plant biostimulant to increase growth of kale.
2. Providing the latest data research especially for farmers about the new source and eco-friendly biostimulant to improve the growth of kale.
3. Adding knowledge to the public the other benefits of *Portulaca oleracea* L. with all the nutrients that it contain.

