I. INTRODUCTION

1.1 Research Background

Biostimulants are organic compounds both natural and synthetic that are not included in the fertilizer group intended to be applied to cultivated plants. This compound is able to promote plant growth (Abbas, 2013), vigor, enhance nutrients and water uptake (Brown and Sebastian, 2015), and increase the response of plants to environmental stress (Du Jardin, 2012). Biostimulants can be obtained from organic ingredients. These organic substances include humus substances (HS), microbial inoculants, amino acids, inorganic salts, chitin derivatives, chitosan, and seaweed extracts (Nardi, Pizzeghello, Schiavon, and Ertani, 2016).

Seaweed as a biostimulant has been widely used to promote plant growth (Du Jardin et al, 2020). In this research, seaweed is considered as one of the most important marine resources for agriculture, but the potential of these marine resource has not been fully harnessed in Indonesia. Seaweed extract has various beneficial components. Considering that Indonesia's marine areas have abundant seaweed resources, it is important to explore the benefits contained in it. 8,642 species of seaweed were recorded in the world and The Data of the Ministry of Maritime Affairs and Fisheries (2015) shows that there are 555 species of seaweed in the coastal of Indonesia.

According to Hadi, Zakaria, and Syam (2016) five species of seaweed distributed along the coast of Nirwana, West Sumatra are *Halimeda* sp., *Padina minor*, *Sargassum crassifolium*, *Sargassum cristaefolium* and *Turbinaria decurrens* which belong to the group of brown seaweed (Phaeophyta). Screening the effectiveness of

five species of seaweed has been carried out by Noli et al (2018 a), and from the experiment, *Sargassum crassifolium* well identified as an important source of biostimulant to increase the germination and growth of several crop plants (Noli et al (2018 b).

According to Sutharsan et al (2017) the application of *S. crassifolium* as biostimulant significantly increased plant height of tomato, increased the leaf area and shoot weight. In the previews investigation showed that foliar application of *S. crassifolium* with 20% concentration (T5) on soybean seedling increased 37.87% of the leaf area average per plant. Also, besides the application of this seaweed extract increased the dry matter accumulation of shoot, root dry weight, fruit number, fruit yield per hectare and does a remarkable effect on the mean number of flowers per plant (Sutharsan, 2014).

Several factors are considered to affect the effectiveness of biostimulant action mode including the location and growing conditions, species, organ, the phase of growth and the formulation of biostimulant. Formulation in biostimulant defines as the process of the natural materials put into a form that be easily produced, keep, transported and makes the treatment processes method safer and more effective. Biostimulants are formulations made from natural raw materials. Raw materials for biostimulants formulations including seeds, leaves, and roots. Basically, there are several types of biostimulant formulation such as dustable powder (DP), formulated from the sorption of plant extract or other principles into solid inert. Wettable powder (WP), is the formula that diluted as aqueous suspension. Soluble liquids (SL), applied as a solution after dilution with water. Emulsifiable concentrates (EC) and water-

dispersible granules (WDG) (Kumar and Purkait, 2020). This research is focused on powder and liquid formulation. Oancea (2016) on the research of dry flowable formulation of biostimulant *Trichoderma strains* developed a procedure for spray-drying alginate encapsulated high density to enhance the survival of dried conidia.

According to El-Hasan (2007) the formulation of Trichoderma strains as biostimulant to find the antagonistic effect of the bioproducts toward *Fusarium moniliforme*. The current results, however, provided the first evidence for the activity of 6PAP, as a Trichoderma secondary metabolite, on degrading/synthesis suppression of the Fusarium toxin FA. Noli et al (2018 c) have investigated the effectiveness of liquid extracts of five species of seaweed on the growth of upland rice.

Soybean (*G. max*) was used as the tested plant in this research to evaluate the effectiveness of *S. crassifolium* extract. Soybean is one of the primary sources of food. Soybean contains a number of fundamental food elements, such as essential fatty acids and fiber which are important for the body. Concurrently with the sizeable reduction of arable lands, besides using soybean as the object, this research also uses Ultisol soil as a growing medium for soybean cultivation. The purpose of this land use was to optimize the potential of suboptimal land. Referring to the objective, it is expected that the application of *S. crassifolium* extract as biostimulant in soybean planted in Ultisol soil media could enhance the quality and production of soybean crops.

1.2 Problem Formulation

The problem to be answered in this research was

1. How effective is the formula of *S. crassifolium* extract as biostimulant on the growth and yield of soybean?

1.3 Objectives

This research aims to:

1. Evaluating the effectiveness of the formula of *S. crassifolium* extract as biostimulant on the growth and yield of soybean.

1.4 Outputs

The benefits obtained from this research are:

1. Contributing to Universitas Andalas for the knowledge about the potential of *S. crassifolium* extract as biostimulant in an effort to increase soybean production.
2. Providing *S. crassifolium* biostimulant extract formula for local farmers in West Sumatra.
3. As a recommendation to the government of West Sumatra to optimize the potential of *S. crassifolium* as a source of biostimulant in an effort to increase the production of crop plants.