ISSN No:-2456-2165

Drip Irrigation and Seed Priming Treatment on Soybeans during the Dry Season in Maros District, South Sulawesi Province, Indonesia

Hendrik Gunadi
Universitas Kristen Indonesia Paulus
Makassar, Indonesia

Machmud Djunaidy
Universitas Kristen Indonesia Paulus
Makassar, Indonesia

Abstract:- Toddolimae and Toddopulia villages are villages that have difficulties in planting soybeans in July or August because the planting area is rainfed rice fields. This study aims to (1) so that soybean seeds can survive in the dry season and (2) utilize the available limited water with efficiently. The method used to carried out by applying technology in the use of superior seeds of Demas 1 and Devon 2 which are dry-resistant and the application of seed priming (hydro and halo priming) technology, and rain harvest technology with water tank and drip irrigation. The results obtained are soybean plants grow well according to the stages of the phenology and can produce well.

Keywords:- *Dry Season; Rain Harvest; Drip Irrigation; Seed Priming*

I. INTRODUCTION

Maros District, located at $119^{0}30'$ BT and $5^{0}00'$ LS, is one of the soybean producing areas in South Sulawesi province, Indonesia. The contribution of Maros District to South Sulawesi soybean production is 14.98% [1]. The low contribution of Maros District in supporting South Sulawesi soybean production is because some soybean plantations are rainfed rice field without irrigation, so that in the dry season there will be difficulties in providing water for soybean plants, so that the fields cannot be planted with soybeans.

Toddolimae Village, located in Tompobulu Subdistrict, Maros District, has an area of 461 ha of soybean plantations with production of 1,896.86 tons [2]. Toddolimae Village cannot plant soybeans in July or August because it has entered the dry season. The soybean planting area in Toddolimae Village generally has a neutral soil pH (6.9) and rainfed, so farmers in Toddolimae Village are forced to rest their land for 3 to 4 months because unavailability of irrigation water. Toddolimae village is far from a water source, so during the dry season no planting of palawija crops can be carried out so that the farmer temporarily do other work to keep earning income during the dry season period.

Likewise with Toddopulia Village in Tanralili Subdistrict which has a soybean plantation area of 91 ha with production of 458.64 tons [3] has the same problem is rainfed rice field without irrigation with acid soil pH (5.0) The location of Toddopulia Village is also far from water sources so that the planting area is very dependent on rainwater. In Toddopulia Village, July or August has also entered a severe dry season, so farmers prefer to rest their land rather than bear the loss of crop because harvest failure due to unavailability of water. Some farmers in Toddopulia Village also choose to do other work as long as their land cannot produce [4].

The dry season which causes drought in Toddolimae and Toddopulia villages results in low production and land use in the dry season. The Parang Lambere Farmers Group in Toddolimae Village and Toddopulia Farmers Group in Toddopulia Village, have taken steps to be able to do soybean planting in the dry season, by providing water only at certain times based on their experiences during soybean cultivation, but the results obtained is still far from expectations and even harvest failure.

Based on the theory of dry land utilization, the use of rainfed rice field can be done by applying the technology of right varieties and seed priming, water management with knowledge of the growth phases of the varieties planted, the use of drip irrigation technology and give of organic matter to the soil to improve physical properties of the soil so that it can improve the ability of the soil to hold water [5],[6].

II. MATERIAL AND METHODS

The method used to overcome the problem of the ability of seeds to survive on land without irrigation in the dry season and the problem of availability and management of water is the treatment of seeds (superior seeds of dry resistance and seed priming) and water management (rain harvest and drip irrigation).

A. Seed Treatment

To enable the seeds to survive on dry land treated with seed priming. Seed priming is the initial treatment of seeds by various methods in order to improve seed germination rates, percentage of germination, uniformity of germinating seeds by controlling the availability of water in the seeds. The seed priming treatment shows the speed of germination in the seed, acceleration of root and shoot growth, and more vigorous plants [7]. On dry land with normal pH, the hydro priming method is usually used (soaking seeds in water), while the dry land with a low pH is used the halo priming method (soaking seeds in salt water). Soaking the seeds in water for 24 hours will protect

ISSN No:-2456-2165

the seeds on dry land [8]. Likewise the give of NaCl) of 4 g /l accelerates the germination of plants [9]. As for increasing the ability of germinating seeds to use superior varieties that are resistant to water stress, namely Devon 2 (seeds soaked in water for 24 hours) and varieties that are acid resistant namely Demas 1 (seeds soaked in NaCl 4g/l for 24 hours).

B. Water Management

Provision of water in the dry season is carried out with a rain harvest through the construction of an iron tower with a height of 5 meters which at its peak is placed a water tank with a capacity of 1200 liters. After the water is harvested during the rain, it is then channeled to the planting area in the dry season with a 1 inch diameter pipe followed by an ¾ inch pipe so that the water pressure in the pipe increases because the pipe diameter is smaller and strengthened by the presence of earth gravity with a 5 meter height difference. Furthermore, to save water used in planting, the water is only flowed to each plant by making a small hole in the secondary hose (3/4 inch) so that the water is only directed at plants and not in all planting areas. This method is known as drip irrigation, where water use is adjusted to the water requirements per plant [10],[11]. Whereas to keep water available in the critical phases of soybean plants [12], irrigation is carried out when the plants are in the germination phase (2-5 days after planting), vegetative growth, (15-20 days after planting), flowering (25-35 days after planting), and when filling pods (55-70 days after planting).

C. Implementation

First, land preparation by making large size beds of 10 meters x 30 meters, and when making beds, the processing of limited land is carried out and directly mixed with compost organic material. Then the seeds are planted with a depth of 2 cm, and the spacing used is 15 cm x 40 cm, but before the seeds have been soaked in water and NaCl solution for 24 hours. Each planting hole is filled with 2 seeds. Seeds soaked in water are planted in Toddolimae Village, while seeds soaked in NaCl solution are grown in Toddopulia Village. Next, a watering installation with a drip irrigation hose is made and a small hole is made in each hole where the seed is planted. Irrigation is carried out when the plants are 3-5 days after planting (germination phase), 15-20 days after planting (vegetative phase), 25-35 days after planting (flowering phase), and 55-70 days after planting (pod filling phase) by drip irrigation. The harvest is done when 95% of the pods are brown or black and most of the leaves have fallen out.

Fig 1:- Soybean Technology Package in the Dry Season at Maros District, South Sulawesi Province.

ISSN No:-2456-2165

III. RESULTS AND DISCUSSION

Technology packages in the form of (1) superior varieties that are dry resistant, (2) seed priming is done by soaking seeds in water (hydro priming) and salt solution (halo priming) intended to 'teach' seeds to be able to deal with unfavorable environments, (3) water tank tower (for rainwater harvesting) as high as 5 meters allow the flow of water at a speed strong enough due to gravity, and (4) drip irrigation is intended to conserve water use in the dry season, so that with very limited water plants soybeans can grow and produce very well, as well as the limited processing of soil and the provision of organic fertilizer at the time of planting will improve the soil structure to become loose around the roots of soybean plants (Fig 1).

Seed priming treatment on soybean seeds enables soybean seeds to survive in very dry conditions and even able to germinate normally [13]. Similarly, the provision of drip irrigation is only on plant roots and at the stage of soybean phenology is able to conserve in the use of water and even spur plant growth due to the fulfillment of plant water requirements at the stage of soybean phenology [14].

The results of field crops show that with the use of superior varieties, drip irrigation and seed priming, soybean seeds can germinate normally (4-5 days after planting) with a growing power of 85% according to the labeling of seed types both in Demas 1 and Devon 2 varieties. This shows that the provision of water is limited only to plants which greatly conserve water use and can spur germination (Fig 2), as well as the treatment of seed priming able to 'teach' seeds to survive in unfavorable environmental conditions namely lack of water and temperature high.

Germination and growth of soybeans in accordance with the stages of soybean phenology, showed that the use of appropriate technology in the form of superior varieties, drip irrigation and seed priming were able to overcome the dry environment (lack of water) and high daily temperatures [15],[16]. As it is known that soybean plants are subtropics plant so they are very sensitive to temperature, however the use of drip irrigation and seed priming technology allows soybean plants to germinate and grow normally under high temperature and lack of water.

Fig 2:- Drip Irrigation System on Soybean in Maros District, South Sulawesi Province

IV. CONCLUSION

The technology package of drip irrigation, superior varieties, and seed priming can be a solution in an effort to plant soybeans in the dry season with high daily temperatures. This technology package has an impact on improving the ability of farmers to utilize science and technology and the maximum land use in the dry season in Maros District.

ACKNOWLEDGMENT

Acknowledgments are addressed to the Directorate of Research and Community Service (DRPM) of the Ministry of Research, Technology and Higher Education which provides funding for the Community Partnership Program (PKM) so that Community Service activities can be carried out.

REFERENCES

[1]. The Central Bureau of Statistics (2017). *Food Plant*. http://www.bps.go.id/ tnmnpgn.php. Accessed on December 21, 2018 .
[2]. The Central Bureau of Statistics of Maros District (2017). *Tompobulu Subdistrict in Figures*. BPS Maros District. Accessed December 21, 2018.
[3]. The Central Bureau of Statistics of Maros District (2017). *Tanralili District in Figures*. BPS Maros District. Accessed on December 21, 2018
[4]. Gunadi, H., K. Kaimuddin, S. Baja, and M. Riadi (2018). Evaluation of the CropSyst model on soybean (Glycine max L.) in the tropics. *International Journal of Environmental & Agriculture Research (IJOEAR)*. 4 (6): 41-45.
[5]. Potova, V., C. Boroneant, B. Boincean, and J. Soukup (2015). Impact of agricultural drought on main crop yields in the Republic of Moldova. *International Journal of Climatology*. 36 (4): 2063-2082.
[6]. Labedzki, L. (2016). Action and measures for mitigation drought and water scarcity in agriculture. *Journal of water and land development*. 29 (1): 3-10.
[7]. H.A., Elkheir, Y. Musa, M. Muslimin, R. Sjahril, M. Riadi, and H. Gunadi (2018). Harvest index and yield components of aerobic rice (Oryza sativa) under effect of water, varieties and seed priming. *IOP Conference Series: Earth and Environmental Science*. IOP Publishing.
[8]. Kazemi, K. and H. Eskandari (2012). Does Priming Improve Seed Performance under Salt and Drought Stress? *Journal of Basic and Applied Scientific Research*. 2 (4): 3503-3507.
[9]. Moradi, A., F. S. Zadeh, R. T. Afshari, and R. M. Amiri (2012). The effects of priming and drought stress treatments on some physiological characteristics of tall wheat grass (Agropyron elangatum) seeds. *International Journal of Agriculture and Crop Sciences*. 4 (10): 596-603.
[10]. Tayel, M., D. Lightfoot, and H. Mansour (2012). Effects of drip irrigation circuit design and lateral line lengths: I-On pressure and friction loss. *Agricultural Sciences*. 3 (3): 392-399.
[11]. Ali, H.B., M. Hammami, A. Saidi, and R. Boukchina (2017). Assessment of a new approach for systematic subsurface drip irrigation management. *International Journal of Agronomy*. (2017): 1-7.
[12]. Asif, M., M. Ahmad, A. G. Mangrio, G. Akbar, and A. H. Memon (2015). Design, evaluation and irrigation scheduling of drip irrigation system on citrus orchard. *Pakistan Journal of Meteorology*. 12 (23): 37-48.
[13]. Shah, H. T. Jalwat, M. Arif and G. Miraj (2012). Seed priming improves early seedling growth and nutrient uptake in mungbean. *Journal of Plant Nutrition*. 35 (6): 805-816.
[14]. Parthasarathi, T., K. Vanitha, S. Mohandass, E. Vered, V. Meenakshi, D. Selvakumar, A. Surendran, N. Lazarovitch (2017). Effect of drip irrigation on growth, physiology, yield and water use of rice. *Journal of Agricultural Science*. 9 (1): 154-163.
[15]. Yan, M. (2015). Seed priming stimulate germination and early seedling growth of Chinese cabbage under drought stress. *South African Journal of Botany*. 99 (2015): 88-92.
[16]. Ibrahim, E. A. (2016). Seed priming to alleviate salinity stress in germinating seeds. *Journal of Plant Physiology*. 192 (2016): 38-46.