UDC 633

INFLUENCE OF MODIFICATION OF GROWTH MEDIUM AND USING OF PLANT GROWTH REGULATOR TO ENHANCE GROWING POWER AND GROWTH OF TRUE SEED OF SHALLOT (TSS)

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ABSTRACT
Red onion is one of the main horticultural commodities in Indonesia. Generally red onion is cultivated by using tuber as a source of seeds. The weakness of the use of tuber as a source of seeds, besides the high cost also the quality of seed is less well guaranteed because it almost always carries of the pathogen disease. To overcome the weakness of red onion cultivation with tuber, the alternative is the cultivation with the seed of botani (True Seed of Shallot/TSS). The weakness of botanical seeds as a source of seed is the low germination/growing power. Therefore, to solve the problem of red onion cultivation with TSS, has been done research on the modification of growing medium and giving of plant growth regulator to produce seeds of red onion origin of botanical seed (TSS). Botanical seeds (TSS) of red onion treated with coconut water and seeded on mixed soil + compost medium, soil + husk charcoal and soil + compost + chaff charcoal produce growing percentage and vegetative growth of optimum seeds. Based on the results of this study, coconut water can be used as a plant growth regulator in red onion seeding by using botanical seed (TSS).

KEY WORDS
Coconut water, growing power, growth medium, plant, growth regulator.

Red onion (*Allium ascalonicum*) is one of horticulture commodities that have long cultivated farmers in Indonesia, and has a high economic value. Therefore, red onion is one type of vegetables that affect the inflation, it is associated with consumption. Red onion is one type of vegetables that demand is so high, considering the red onion is consumed daily as a mixture of cooking spices. Consumption of red union of Indonesian people since the period 1993-2012 shows a fluctuating, but relatively increased (Pasaribu dan Daulay, 2013). If in 1993 the average consumption of red onion was only 1.33 kg/capita/year, in 2012 the consumption of red onion increased to 2,764 kg/capita/tahun (Directorate General of Horticulture, 2013).

Red onion demand for consumption has not been followed by increased of production. Red onion production in Indonesia is still low compared to its potential. There are many factors causing low productivity of red onion, including declining of soil fertility, high incidence of plant disturbing organisms, micro-climate change, and low quality of seeds used (Triharyanto, et al., 2013). The use of good quality seed is a very important factor to increase the productivity of red onion (Sumarni, et al., 2012).

In increasing the production of red onion, the main problem faced is the provision of quality seeds, resistant of pest and disease, high yielding and cheap price. According to Margiwiyatno and Sumarni (2011) from the survey, the problems in red onion seed enterprises are: (1) the cultivation process is more complicated than the planting of red onion for consumption, (2) costly, (3) narrow land ownership, (4) planting should be done regularly every month. Need to find solution to the problem of red onion seeding with tubers.

The weakness of vegetative propagation by tubers can be overcome by multiplication through the seeds of the botanical red onion (TSS). Therefore, the use of botanical seeds is one of the alternatives that can be developed to improve the quality of red onion seeds (Permadi, 1991, Raduica, 2008; Sumarni, et al., 2005; Sopha, 2010). Red onions are essentially flowering plants and can be rapidly propagated through large quantities of seeds

(Grubben, 1994). In Indonesia, multiplication of red onion processing through TSS has long been done, but the results have not been applied by many farmers. The cause is a lot of problems encountered in the cultivation of red onions by using botanical seeds (Triharyanto, et al., 2013).

Seeds are one of the factors that determine crop productivity. In addition to using tubers, multiplication of red onions can also use botanical seeds (TSS) as a source of seeds. The use of botanical seeds compared with the use of seed tubers (conventional way) has several advantages, that is the number of botanical seed needs is less between 3-6 kg/ha, while the need for seed tubers ranging from 1 to 1.5 t/ha, storage and distribution of botanical seeds easier and cheaper, produce a healthier plants because botanical seeds are free from the pathogen, and also produce better quality tubers (Ridwan, et al., 1989, Rosliani, et al., 2005). In addition, the use of onion botanical seeds is economically viable as it can increase yields twice as much compared to conventional use of seed tubers (Basuki, 2009).

Red onion seeds are generally round or flat, black with a blunt tip. Seed skin when young is clear or white, but when the old seeds of the skin become black. Seeds can be used as planting materials or seeds. Normal red onion seeds have a structure consisting of testes, endosperms, and embryos. The normal embryo is curved and has one cotyledon in the endosperm. The use of red onion botanical seeds as seeds or planting materials is a problem of low growing power, it is related to seed structure such as skin, endosperm and embryo (Wulandari, et al., 2014).

Planting medium affect the growth and production of plants. Many of planting medium are not soil that needs to be studied for the production of onion tubers derived from botanical seeds. Not soil meidum that potential for the medium planting red onion botanical seeds, especially in the seeding phase one of them is compost. Compost is organic waste derived from plants, animals and organic wastes that have undergone the process of decomposition or fermentation (Haryadi, 2012). In addition to medium, the growth and development of plants is controlled by several of substances commonly known as growth hormone or fitohormon. It is commonly known to be five groups of plant hormones, that is auxin, cytokines, gibberellins, ethylene, and inhibitors. Plant hormones are part of the genetic regulatory process and serve as a precursor (Siagian, 2011).

Therefore, to solve the problems of red onion cultivation with TSS, it is necessary to study the modification of growth medium and giving of plant growth regulator to produce seeds of red onion from botanical seed (TSS).

METHODS OF RESEARCH

Materials needed in this research, including: 1. TSS of Trisula varieties; 2. ZPT (auxin, cytokines, gibberellins); 3. Coconut water; 4. Compost; 5. Charcoal husk; 6. Soil; 7. Other supporting materials (fertilizers, pesticides, etc.).

Research location in BBP Pare, Kediri. The research was conducted at BPP with consideration of the dissemination aspect of this research activity. The study was conducted from April to May 2017.

The fieldwork was arranged based on Factorial Random Design with 2 factors. First factor is a composition of growth medium, consisting of 3 levels of M1: compost + soil (1: 1), M2: charcoal husk + soil (1:1), M3: compost + soil + charcoal husk (1:1: 1) . While second factor is a type of plant growth regulator consists of 4 levels, namely H1: auxin + cytokinin (200 ppm), H2: auxin + giberelin (200 ppm), H3: auxin + cytokinin + giberelin (200 ppm), and H4: coconut water. There are 12 combinations of treatments, namely:

1. M1H1	5. M2H1	9. M3H1
2. M1H2	6. M2H2	10. M3H2
3. M1H3	7. M2H3	11. M3H3
4. M1H4	8. M1H4	12. M3H4

In accordance with the combination of treatment, then there are 12 bedsbed nursery, with the area of each bed 3 m^2. Before seeds are seeded in a bed of seedlings, seeds first soaked into a solution of plant growth regulator (according to treatment) for overnight (24 hours). Further seeds sown to the seedbed nursery in accordance with the combination of treatment. Seeds are spread evenly in 2 cm deep beds. Observation until 6th week after seedling, including growth/germination and vegetative growth component (number of leaves, plant height). The observed growing power included all plots/beds, while vegetative growth observation was conducted on 10 randomly selected sample plants. One week observation interval. To determine the effect of treatment, the data obtained were analyzed using Anova and if any effect of treatment was continued with Duncan test.

RESULTS AND DISCUSSION

Statistical analysis showed that the interaction of plant growth regulator with the composition of seed medium affecting the growing power/seedling of TSS seeds. The results showed that red onion botany (TSS) seeds began to grow in the second week after seedling. The slow growth of this TSS may not be separated from the structure of the seeds (Figure 1) where the red onion botanical seeds have a thick layer of skin.

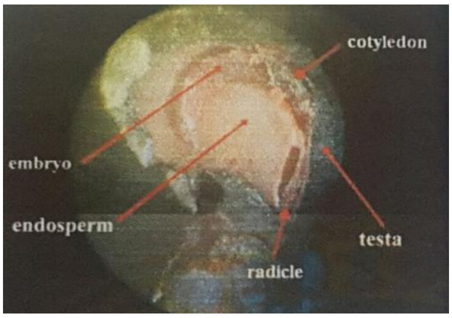

Figure 1 – Red Onion seed structure (Source: Moeljani, 2014)

Until 6th weeks after seedling, TSS treated with coconut water and applied to all seed medium composition treatments showed that the percentage grew the greatest, ie, approaching 90%. Whereas treated with plant growth regulator solution auxin + cytokinin + gibberellin the lowest growth, ie less than 50% (Table 1).

Table 1 shows that TSS treated with coconut water (H4) and seeded on compost + soil mix medium (M1), soil + charcoal husk (M2) and soil + compost + charcoal husk (M3) since inception of germination until age 6 weeks after seedling showed the largest germination rate (growing power). This is because coconut water is able to stimulate germination and growth of TSS. Wowon (2014) and Anonymous (2016) revealed that coconut water is one of the natural ingredients containing growth hormone cytokinin with a concentration of 5.8 mg/L; 0.07 mg/L auxin, and little gibberellin and other compounds that can stimulate germination and growth.

Table 1 – Percentage observations grew from 2nd week to 4th week

Treatment	Growing Power of TSS (%)				
	2 weeks after the seedling	3 weeks after the seedling	4 weeks after the seedling	5 weeks after the seedling	6 weeks after the seedling
H_1M_1	31 a	34 a	42 a	147 a	58 a
H_1M_2	27 a	29 b	36 b	45 b	46 b
H_1M_3	17 b	23 c	28 c	35 c	72 c
H_2M_1	30 a	47 d	48 d	54 d	72 c
H_2M_2	29 a	35 e	36 b	50 e	69 d
H_2M_3	31 ab	40 f	49 d	64 f	73 ef
H_3M_1	9 c	13 g	23 e	35 c	40 g
H_3M_2	12 d	30 h	39 f	43 g	49 h
H_3M_3	7 e	13 g	25 h	36 c	40 g
H_4M_1	62 f	75 i	81 h	85 h	89 i
H_4M_2	59 f	72 i	73 i	82 h	89 i
H_4M_3	65 f	69 i	81 h	86 h	89 i

Description: The numbers in the same column accompanied by the same letter show no significant difference based on the t-test level of 5%.

The results of statistical analysis show that the interaction between the treatment of plant growth regulator with the composition of nursery medium had an effect on the vegetative growth of TSS seed. Vegetative growth of TSS seeds observed included the number of leaves and plant height. Until the age of 6 weeks after seedling TSS seed treated with coconut water (H4) show good vegetative growth. At the age of 6 weeks after seedling, TSS seeds treated with coconut water and sowing to compost + soil mix medium (M1), soil + charcoal husk (M2) and soil + compost + charcoal husk (M3) had the highest number of leaves with range 3,6 -4,2 (Table 2). The same is true for plant height, until 6 weeks after seeding of TSS seeds treated with coconut water and sowing on compost + soil mix medium (M1), soil + charcoal husk (M2) and soil + compost + charcoal husk (M3) showed the highest performance with a range of 28 - 30 cm (Table 3).

Table 2 – Number of TSS seed leaves at 2nd, 3rd, 4th, 5th and 6th weeks after seedling

Treatment	Number of leaves (strands)				
	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks
H_1M_1	1,4 bc	2,0 c	2,6 b	3,0 bc	4,0 abc
H_1M_2	1,2 c	2,0 c	3,0 a	3,2 abc	4,0 abc
H_1M_3	2,0 a	2,0 c	3,0 a	3,2 abc	3,8 bc
H_2M_1	2,0 a	2,6 b	3,0 a	3,4 ab	4,4 a
H_2M_2	1,4 bc	2,0 c	2,2 c	2,6 c	3,0 e
H_2M_3	1,0 c	2,0 c	3,0 a	3,2 abc	4,2 ab
H_3M_1	1,2 c	2,2 c	2,6 b	3,2 abc	4,2 ab
H_3M_2	1,0 c	2,0 c	2,0 c	3,0 bc	3,2 de
H_3M_3	1,0 c	2,0 c	2,0 c	3,0 bc	3,0 e
H_4M_1	1,8 ab	3,0 a	3,0 a	3,2 bc	4,0 abc
H_4M_2	1,4 bc	2,6 b	3,0 a	3,8 a	4,2 ab
H_4M_3	1,4 bc	2,2 c	3,0 a	3,4 ab	3,6 cd

Description: The numbers in the same column accompanied by the same letter show no significant difference based on the assistive test level 5%.

Table 3 – TSS seed height at 2nd, 3rd, 4th, 5th and 6th weeks after seedling

Treatment	Plant height (cm)				
	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks
H_1M_1	9,84 e	14,58 cd	18,52 bcd	21,78 bc	24,56 cde
H_1M_2	11,98 bc	14,74 cd	17,56 def	22,22 bc	26,30 bcd
H_1M_3	8,58 f	10,90 f	13,60 gh	17,36 de	21,06 fg
H_2M_1	11,44 c	17,38 a	20,92 ab	25,60 a	30,14 a
H_2M_2	11,08 cd	13,32 de	15,94 efg	19,92 cd	23,80 def
H_2M_3	12,42 b	16,48 ab	19,80 abcd	23,42 ab	27,96 abc
H_3M_1	10,42 de	14,52 cd	18,04 cde	22,08 bc	27,24 abc
H_3M_2	10,18 de	12,72 e	15,46 fg	17,98 de	21,66 efg
H_3M_3	8,42 f	10,10 f	12,56 h	16,06 de	19,56 g
H_4M_1	12,72 b	17,82 a	22,04 a	26,18 e	30,16 a
H_4M_2	12,60 b	15,30 bc	18,60 bcd	23,88 ab	28,16 ab
H_4M_3	13,94 a	16,92 a	20,36 abc	24,63 ab	28,40 ab

Description: The figures in the same column accompanied by the same letter show no significant difference based on the assistive test level 5%.

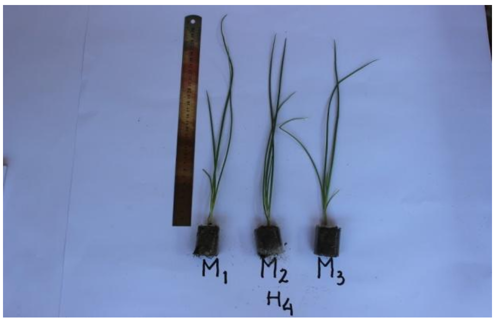

Figure 2 – The seeds of vegetative growth of TSS seeds at 6th weeks after seedlings treated with coconut water (H4) and seeded on soil + compost mix medium (M1), soil + charcoal husk (M2) and soil + compost + charcoal husk (M3)

It appears that TSS seeds treated with coconut water and applied to a mixed medium containing compost and charcoal husk show a good vegetation growth (Fig. 1). Seedlings medium affect to the growth of seeds. Non-soil medium with potential for nursery medium is compost and charcoal husk. The use of charcoal husk as a mixture of nursery medium can increase root growth (Trisnadi, 2016). Chemically, compost can increase cation exchange capacity in the soil. The better capacity of cation exchange so the more important elements are available that are easily absorbed by plant roots.

CONCLUSION

Botanical seed (TSS) of red onion treated with coconut water and sowing on soil + compost mix medium, soil + charcoal husk and soil + compost + charcoal husk yield growing percentage and vegetative growth of optimum seeds.

Coconut water can be used as a plant growth regulator in red onion nursery by using botanical seed (TSS).

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REFERENCES

1. Anonim. 2016. Kandungan air kelapa. http://airkelapahijau.blogspot.co.id
2. Basuki, R. S. 2009. Analisis Kelayakan Teknis dan Ekonomis Teknologi Budidaya Bawang Merah Dengan Biji Botani dan Benih Umbi Tradisional. J. Hort. Vol. 19, No. 2: 214-227
3. Direktorat Jenederal Hortikultura. 2013. Data SUSSENAS. Kemeneterian Pertanian. Jakarta
4. Grubben, G. J. H. 1994. Contraints for Shallot Garlic, and Welsh Onion in Indonesia: a Case Study on The Evolution of Allium Crops in the Equatorial Tropics. Acta Horticulturae 358: 333-339
5. Haryadi, L. 2012. Pupuk Organik. http://lisnawatiharyadi.blogspot.co.id
6. Margiwiyatno, A. dan E. Sumarni. 2011. Modifikasi Iklim Mikro pada Bawang Merah Hidroponik dalam Memperoleh Bibit Bermutu. JTEP Jurnal Keteknikan Pertanian. Vol. 25, No. 1: 43-47
7. Moeljani, I. R. 2014. Upaya Meningkatkan Pembungaan serta Pembijian True Shallot Seed (TSS) Tanaman Bawang Merah (*Allium cepa var ascalonicum* Linn) Melalui Pengaturan Panjang Hari dan Aplikasi GA3. Disertasi. Program Studi S3 MIPA. Fakultas Sains dan Teknologi. Universitas Airlangga. Surabaya
8. Pasaribu, T. W., dan M. Daulay. 2013. Analisis Permintaan Impor Bawang di Indonesia. Journal Ekonomi dan Keuangan. Vol. 1, No. 4: 14-26
9. Permadi, A. H. 1991. Penelitian Pendahuluan Variasi Sifat-sifat Bawang Merah yang Berasal dari Biji. Bul. Penel. Hort. Vol. 2, No. 4: 120-131
10. Raduica, D. P. 2008. Research as the Biology, Technology and Use of Shallot (*Allium ascalonicum*). Hort. Magazine 8: 250-257
11. Ridwan, H., H. Sutapraja dan Margono. 1989. Daya Produksi dan Harga Pokok Benih/biji Bawang Merah. Bul. Penel. Hort. Vol. 17, No. 4: 57-61
12. Rosliani, R., Suwandi dan N. Sumarni. 2005. Pengaruh Waktu Tanam dan Zat Pengatur Tumbuh Mepiquat Klorida terhadap Pembungaan dan Produksi Biji Bawang Merah (TSS). J. Hort. Vol. 15, No. 3: 192-198
13. Siagian, P. 2011. Hormon dan Zat Pengatur Tumbuh. http://ilmu-tanah.blogspot.co.id
14. Sopha, G. A. 2010. Teknik Persemaian True Shallot Seed (TSS). Balai Penelitian Sayuran. Lembang

15. Sumarni, N., E. Sumiati dan Suwandi. 2005. Pengaruh Kerapatan Tanaman dan Aplikasi Zat Pengatur Tumbuh terhadap Produksi Umbi Bibit Bawang Merah Asal Biji Kultivar Bima. J. Hort. Vol. 15, No. 3: 208-2014
16. Suwandi, Sartono dan N. Gunaeni. 2012. Laporan Akhir Perbaikan Produksi TSS (True Shallot Seed) untuk Meningkatkan Pembungaan dan Pembijian Bawang Merah. Kementerian Riset dan Teknologi
17. Triharyanto, E., Samanhudi, B. Pujiasmanto dan J. Purnomo. 2013. Kajian Pembibitan dan Budidaya Bawang Merah (*Allium ascalonicum* L) melalui Biji Botani (True Shallot Seed). Makalah disampaikan pada Seminar Nasional Fakultas Pertanian UNS Surakarta dalam rangka Dies Natalis tahun 2013
18. Trisnadi, R. 2016. Manfaat Arang Sekam untuk Pertanian. http://disbunhut.probolinggokab.go.id
19. Wowon. 2014. Air Kelapa Sebagai Zat Pengatur Tumbuh pada Tanaman. http://cumaorganik.blogspot.co.id
20. Wulandari, A., D. Purnomo dan Supriyono. 2014. Potensi Biji Botani Bawang Merah (True Shallot Seed) sebagai Bahan Tanam Budidaya Bawang Merah di Indonesia. El-Vivo. Vol. 2, No. 1: 28-36