NEW PLANT GROWTH REGULATOR FORMULATION FOR IMPROVING THE TOMATO CROP

C. MALARVIZHI, P. SUBRAMANIAN

Abstract: A plant growth regulator is an organic compound, either natural or synthetic, that control the one or more specific physiological processes within a plant. If the compound is produced within the plant it is called a plant hormone. Distillery is one of the promising industries in India and in recent years its growth is phenomenal which besides alcohol production, generates enormous quantity of spentwash annually. It is also a very good source of readily available major and micronutrients. Recently, the presence of appreciable quantity of plant growth promoters viz., gibberellic acid and indole acetic acid have also been detected which further enhance the nutrient value of spentwash. Now an attempt has been made to alter the distillery spentwash for the support of beneficial microorganism. The growth of *Azospirillum* in modified spentwash was further confirmed by plating and biochemical test method. An experiment was conducted to find out the effect of modified spentwash as plant growth regulators on tomato crop. Five different method of application were used as treatments, viz. Control (no application of plant growth regulator) Seed treatment, Root dipping, foliar application in the study. The growth and yield contributing characters were significantly differed due to different plant growth regulators on tomato. The maximum Root biomass (Weight - 9.2 g & Length- 19cm), No. of. Flower cluster (48nos), Average Fruit length and grith (5.8 cm & 23cm), Fruit weight (191g) and the Tomato yield per hectare (39903 kg ha^{-1}) were found in modified spentwash application and the minimum for all the parameters were found in control treatment.

Key words: Plant growth regulators, Modified spentwash, Indole acetic acid, *Azospirillum sp,* Seed treatment, Root dipping, Foliar spray.

Introduction: Plant growth regulators (auxins, gibberellin and cytokinin) are organic compounds other than nutrients that modify plant physiological process. Plant growth regulators called bio stimulants or bio inhibitors act inside plant cells to stimulate or inhibit specific enzymes or enzyme system and help to regulate plant metabolism. They are normally active at very low concentration in plants. Growth regulating chemicals that have positive influences on crop yield.

The treated distillery spentwash is a nutrient rich liquid organic waste generated as a byproduct after the distillation of molasses. It is also a very good source of readily available major and micronutrients. Recently, the presence of appreciable quantity of plant growth promoters viz., gibberellic acid and indole acetic acid have also been detected which further enhance the nutrient value of spentwash (Hukkeri, 2013). As much as spent wash is concerned, scientific experimentation technologies are required for effective utilization of this valuable resource in agriculture field which is safe to environment (Palaniswami *et al.,* 2011).

Plant growth substances are essential for growth and development of any plant. It plays an important role in flowering, fruit setting ripening and physiochemical changes during storage of tomato. Application of IAA as foliar sprays or root dipping of tomato plants had a stimulatory effect on controlling fruit setting, pre harvest fruit drop, increasing the fruit yield and extending shelf-life (Adlakha and verma, 1965). Fruit set in tomato was successfully improved by application of IAA (Mukherji, 1966). In fact the use of growth regulators had improved the production of tomato including other vegetables in respect of better growth and quality, which ultimately led to generate interest between the scientists and farmers for commercial application of growth regulators (Sanyal *et al.,* 1995). So the present investigation was undertaken to find out the formulate the modified spentwash as a plant growth regulators on growth and yield of tomato.

Materials and Method:

Modification of distillery spentwash to support beneficial organism: Modification of distillery spentwash study was conducted in the Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore. The biomethanated distillery spentwash sample was collected from the M/s. Bannari Amman Sugars Ltd., located at Periyapuliyur, Bhavani taluk, Erode district, Tamil Nadu. In 250 ml Erlenmeyer flask 100ml of 10% spentwash (10ml spentwash+ 90 ml of water) was taken and Mallic acid was added for *Azospirillum* as a carbon source at the rate of 0.5 g per 100ml of spentwash sterilized in an autoclave for 121 °C for around 15–20 minutes. *Azospirlillum* Pure culture was obtained from the Department of Microbiology, TNAU, Coimbatore. One ml *Azospirlillum* pure culture was inoculated on to the respective flask and incubated for 72hrs. The growth of *Azospirillum* in modified spentwash was further confirmed by plating and biochemical test.

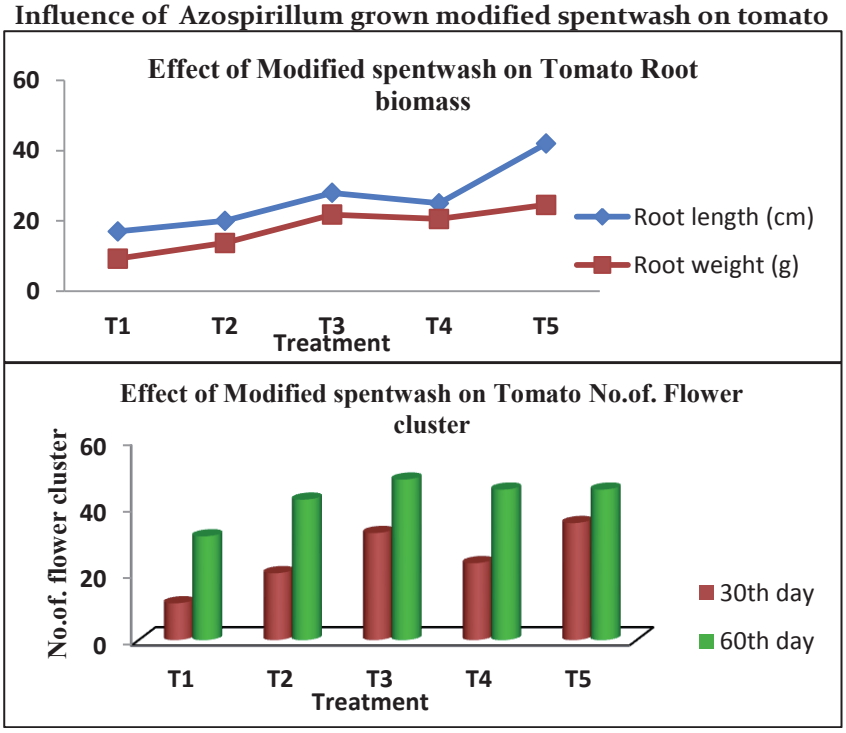
1ml of modified spentwash broth culture was inoculated into N- free semi solid malic acid media (Singh and Tilak, 1999) and subsurface pellicle formation was observed after the 5 days of incubation. Methyl red and carbohydrate fermentation biochemical test (MacFaddin, 1980) were followed for the confirmation of *Azospirillum sp.* After the growth confirmation in modified spentwash, it was mass multiplied (5 liter) and estimated the IAA concentration in the broth culture and test the efficiency in tomato crop. A field experiment was conducted in tomato with randomized block design (5 treatment and 3 replication) using PKM- 1 as a test variety. The main treatments were apart from control, Seed treatment, seed treatment with root dipping, Seed treatment with foliar application, and combination of root dipping and foliar application. The tomato seeds were soaked with *Azospirillum* grown modified spentwash for a period of 30minutes and sown in protray. After 30days of growth, seedlings were transplanted in to main field. At the time of transplanting the root of the tomato seedlings were dipped in the *Azospirillum* grown modified spentwash for 30 minutes. Again *Azospirillum* grown modified spentwash was applied as foliar spray on the pre flowering stage of tomato to induce the flowering and fruit setting.

Result And Discussion:

Modification of distillery spentwash to support beneficial organism: The *Azospirillum sp.* colonies present in modified spentwash were showed positive growth confirmation with various sources of carbon and methyl red biochemical test but negative in the Voges test. These results proved the *Azospirillum* were grown very well in the modified spentwash. Microbial culture was mixed with the salkowski reagent and developed pink colour, which indicated the production of IAA concentration in modified spentwash and OD value was measured by spectrophotometer at 530nm with standards. Indole acetic acid and indole lactic acid were produced by *A. brasilense* which gave a positive results on salkowski reagent. Same trends of results were reported by Hormens et al., 1985.

Microbes	IAA concentration	Glucose	Sucrose	Lactose	Methyl red	Voges test
Azospirillum	5.3 ppm	AG	AG	A	+ve	-ve
AG- Acid and gas formation; A- Acid formation; +Ve -positive result; -ve – Negative result						

Influence of Azospirillum grown modified spentwash on tomato



Tomato root biomass: Highest Root biomass (Wt- 24.5g & L- 42cm) and Vegetative growth was observed in the T_5 treatment (Seed treatment +Root dipping +Foliar spray) compared to control (Wt - 9.2 g & L- 19cm). IAA secreted by a bacterium may promote root growth directly by stimulating plant cell elongation or cell division or indirectly by influencing bacterial ACC deaminase activity. ACC deaminase,

produced by many plant growth-promoting bacteria is involved in the stimulation of root elongation in seedlings. The result of the resent study divulged with the result of Adlakha and Verma(1965).

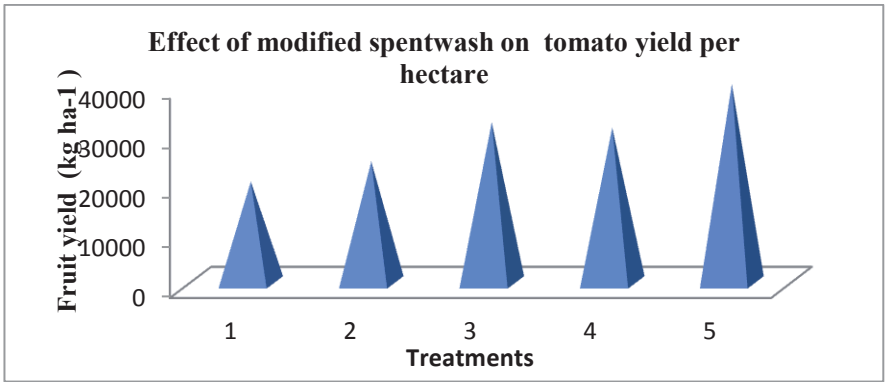
Number. of. Flower cluster: The Number. of flower cluster was counted on 30 and 60DAP of tomato. The Number of flower cluster of tomato was influenced by the treatments and was maximum (48 nos) in seed treatment + Root dipping (T3) followed by T4& T5 (45nos). Lowest No. of flower cluster was recorded in absolute control (T1) (31nos). It was revealed that modified spentwash gave the higher number of flowers cluster . Similar trend of the result was found by Onofeghara(1983) and Leonard *et al.*(1983).

Yield parameter:

Tomato yield per hectare: Weight of fruits from each plot was recorded and yield computed to kg $ha^{-1)}$ (Tab.2.). The fruit yield was maximum in Seed treatment +Foliar application + Root dipping (T5) recording 39903 kg ha^{-1}. The lowest yield (20328 kg ha^{-1}) was recorded in absolute control (T1). Significant interaction effect was noticed between the treatments. IAA content in the Modified spentwash increased the number and weight of fruits plant and thus increased in yield of tomato. These findings were supported by the results of Kaushik *et al.,* 1974 and Saleh and Abdul(1980).

Treatment	Fruit yield (kg ha^{-1})
T1	20328
T2	24358
T3	32213
T4	31153
T5	39903

T_1– Absolute control; T_2– Seed treatment with modified spentwash; T_3 – Seed treatment +Root dipping ; T_4 – Seed treatment +Foliar spray; T_5 – Seed treatment +Root dipping +Foliar spray



Fruit weight: The tomato fruit weight ranged from 15.7 to 23 cm. The fruit girth significantly increased due to modified spentwash application. The treatment T_5 recorded the maximum value (191g) of fruit weight followed by T_3 (19cm) and the minimum value of 64g was observed in T_1 (control). Invariably all the treatments performed better under modified spentwash application. Application of IAA at vegetative stage increased the fruit size which increased individual fruit weight. Kaushik *et al* (1974) supported this argument. But Sanyal *et al.*(1995) found that foliar application was more effective than root soaking of seedling on tomato

Average Fruit length and grith: The fruit length and grith statistically significant variation due to different application of modified spentwash. The treatment T_5 (Seed treatment + Root dipping + Foliar application) recorded the maximum mean value of fruit length and grith (5.8 cm & 23cm) and the lowest fruit length and weight (3.2 cm & 15.7) was observed in T_1 (control). Hence the IAA application indicated the possibility of increasing tomato fruit length and grith. However, the report by Hathout, et al.(1993) indicated the significant role of GA in tomato plant to increase fruit set that leads to larger number of fruits per plant and increased fruit size.

Table.3.Effect of modified spentwash application on tomato fruit weight, length and grith

Treatment	Fruit weight (g)	Fruit length (cm)	Fruit grith (cm)
T1	64.37	3.2	15.7
T2	109.3	3.8	17
T3	113.44	4	19
T4	121.12	4	18.5
T5	191.58	5.5	23

T_1– Absolute control; T_2– Seed treatment with modified spentwash; T_3 – Seed treatment +Root dipping ; T_4 – Seed treatment +Foliar spray; T_5 – Seed treatment +Root dipping +Foliar spray

Conclusion: Based on the above results, it could be concluded that various methods of modified spentwash application on tomato results in higher performance of growth, yield and quality parameters. Invariably all the treatments performed better under modified spentwash application. Modified spentwash were well performed as a plant growth regulators and it can be recommended to the vegetable growers for better production.

References:

1. Adlakha, P.A. and S.J. Verma. 1965. Effect of gibberellicacid on fruiting and yield of tomato fruit. . **Global J. Pure Appl. Sci. 5(1):** 27-30.
2. Hathout, T.A., S.A. Sheteawi and S.M. Khallal, 1993. I.Effect of mode of application of some growth regulatorson the physiology of tomato plants. II. Effectof IAA on endogenous hormonal contents. **Egyptian J. Physiol. Sci., 17(1):** 45-62.
3. Horemans, S., K. Vlassak. 1985. Production of indol-3-acetic acid by Azospirillumbrasilense. In: W. Klingmuller (Ed.),Azospirillum III: genetics, physiology, Ecology Springer-Verlag, Berlin, 1985, pp 98-108.
4. Hukkeri P.A , P. M Munnoli and R. B Gadag.2013. Effect of distillery spent wash on macronutrients of vermicompost. **Int. J. Cur. Eng. and Tech., 42 (1):**1-8.
5. Kaushik,M.P., J.K. Sharma and 1. Singh, 1974. Effectofalpha naphthalene acetic acid, Gibberellic acid, kinetinand morphactin of yield of tomato**. Plant Sci, 6:** 51-53.
6. MacFaddin. 1980. Biochemical tests for Identification of Medical bacteria , pp: 51-54. Williams and Wilkins, Baltimore, USA.
7. Mahadevan, A. and R. Sridhar, R. 1982. Methods in Physiological Plant Pathology (2 nd Edn). Sivakami Publication, Madras, India.
8. Mukherji,S.K. and B.K. Roy.1966. Reducing fruit drop in West Bengal. **World Crops, 18(3):** 34.
9. Onofeghara, F.A., 1983. The effect of growth substanceson flowering and fruiting of Lycopersicon esculentumandVigna unguiculata. **Phytol. Argentina., 40(1):** 107-116.
10. Palaniswami R., M. Anandhakumar and N Nagarajan. 2011. Distillery Spent Wash, an Ameliorant for Domestic Waste Composting and Vermicomposting**. *J. Indian Soc. Soil Sci. 1:***1-5
11. Saleh,M.M.S. and K.S. Abdul, 1980. Effect of gibberellic acid and cycocel on growth, flowering and fruitingof tomato (Lycopersicon esculentum) plants. **Mesopotamia J. Agric., 15(1):** 137-166
12. Sanyal,D., P.L. Kar and M.Longkumar, 1995. Effect of growthregulators on the physico-Chemical compositionof tomato (Lycopeersicen esculentum by Mill.). Adv. Hort For., 4: 67-71.
13. Singh, G. and K.V.B.R. Tilak. 1999. Azospirillum-current status. In: Current Trends in Life Sciences. Agromicrobes,23: 93-106.

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