อิทธิพลของน้ำหมักชีวภาพจากมูลวัวต่อดอกดาวเรือง

Influence of Vermicompost Tea from Cow Manure on Marigold

ขนิษฐา ภมรพล[1], และ ณัฐสิมา โทขันธ์[1*]

Kanittha Pamonpol[1] and Natsima Tokhun[1*]

บทคัดย่อ: ปัญหาขยะมูลฝอยเป็นปัญหาสำคัญในระดับโลก ดังนั้น งานวิจัยนี้พยายามลดปริมาณขยะชีวภาพโดยการเลี้ยงไส้เดือนเพื่อเปลี่ยนมูลวัวให้กลายเป็นปุ๋ย จากนั้นจึงทำน้ำหมักมูลไส้เดือนจากปุ๋ยดังกล่าวซึ่งเป็นอาหารของพืชโดยกระบวนการทางธรรมชาติ สามารถเพิ่มผลผลิต ปรับปรุงสมบัติทางเคมีของดิน และลดการเกิดโรคในพืชรวมถึงโรคในมนุษย์ โดยในงานวิจัยนี้มีวัตถุประสงค์ในการศึกษาอิทธิพลของน้ำหมักมูลไส้เดือนต่อการเจริญเติบโตและผลผลิตของดอกดาวเรือง ปุ๋ยมูลไส้เดือนมีที่มาจากการเลี้ยงไส้เดือนสองสายพันธุ์ ได้แก่ African Night Crawler (AF) และ European Night Crawler (Euro) ทำการทดลอง 3 ชุด โดยแต่ละชุดทำการทดลองซ้ำ 3 ครั้ง เพื่อวัดค่าความสูง เส้นรอบวงลำต้น และจำนวนดอกดาวเรือง ชุดการทดลองประกอบด้วย ชุดควบคุม(ใช้น้ำประปา) ชุดน้ำหมักมูลไส้เดือนดินสายพันธุ์ AF และชุดน้ำหมักมูลไส้เดือนดินสายพันธุ์ Euro บันทึกผลการทดลองในวันที่ 0, 3, 6, 9, 12 และ 15 วันหลังการทดลอง การวิเคราะห์ทางสถิติใช้การคำนวณโดยแผนการทดลองแบบสุ่มตลอดเพื่อพิจารณาการเจริญเติบโตและผลผลิตของต้นดาวเรือง จากผลการทดลองพบว่า น้ำหมักมูลไส้เดือนสามารถเพิ่มความสูง เส้นรอบวง และจำนวนดอกดาวเรืองได้ โดยการทดลองที่ใช้น้ำหมักมูลไส้เดือนดินสายพันธุ์ AF มีเจริญเติบโตและผลผลิตของดาวเรืองสูงที่สุด
คำสำคัญ: ดาวเรือง, ไส้เดือนสายพันธุ์ AF,ไส้เดือนสายพันธุ์ Euro,น้ำหมักมูลไส้เดือน, มูลวัว

Abstract: Solid waste is a serious global problem. This research has tried to reduce biological waste by using cow manure as food for worms. The worms transformed cow dung to vermicompost. Then we produced tea from the vermicompost. The vermicompost tea is nutrient for plants that made from natural process. It can gain yield, improve soil chemical properties, and reduce diseases in plants and humans. We expected to gain yield of marigold plants, reduce solid waste, and reduce chemical application. This study focused on influence of vermicompost teas from cow manure on marigold growth and yield. The vermicompost was derived from two species of worm: African Night Crawler (AF) and European Night Crawler (Euro). Three treatments and three replications were performed to monitor height, grit, and number of marigold flowers. The three treatments consisted of control (water supply), vermicompost tea from AF, and vermicompost tea from Euro. The data was recorded at 0, 3, 6, 9, 12, and 15 days of the experiment. The statistical analysis was calculated by a completely randomized design (CRD) method design for marigold growth and production. The vermicompost tea could increase height, grit, and number of marigold flower. The maximum growth and yield of marigold was found in application of the vermicompost tea from AF worm.
Keywords: marigold, American Night Crawler, European Night Crawler, vermicompost tea, cow manure

[1] หลักสูตรวิทยาศาสตร์สิ่งแวดล้อม คณะวิทยาศาสตร์และเทคโนโลยี มหาวิทยาลัยราชภัฏวไลยอลงกรณ์ ในพระบรมราชูปถัมภ์
Environmental Science Program, Faculty of Science and Technology, Valaya Alongkorn Rajabhat University under the Royal Patronage

* Corresponding author: natsima@vru.ac.th

Introduction

Solid waste is recently global problem that need management to remove them. The management could be done by following priority: reduce, reuse, recycle, recover, and landfill (Nehrenheim, 2014). An option to reduce solid waste is transforming it to useful product such as vermicompost. The vermicompost could be product from various waste such as cattle manure, horse manure, cow manure, sheep manure, duck waste, municipal solid waste, industrial waste, food waste, and so on. Therefore, it was environmental friendly product. Due to overpopulation, more agricultural products were required for food. Inorganic fertilizer was applied to increase nutrient in soil for increasing yield. However, it has long term adverse effect on soil properties. Therefore, researchers have tried to convince farmer to use natural process product of vermicompost.

"The vermicompost are products derived from the accelerated biological degradation of organic wastes by earthworms and microorganisms" (Arancon and Edwards, 2005). Many studies examined physical and chemical properties of vermicomposts. The characteristics are similar to peat with high porosity, aeration, drainage, water-holding capacity (Edwards and Burrows, 1988). It provided large surface area so it had strong capacity to hold and retain nutrients (Shi-wei and Fu-shen, 1991). Good characteristics of vermicompost for soil were low content of soluble salts, high cation exchange capacity, and high humic acid contents (Albanell et al., 1988). The vermicompost provided nutrient that plants can uptake directly such as calcium, magnesium, nitrates, exchangeable phosphorus, and soluble potassium (Edwards and Burrows, 1988; Orozco et al., 1996). Various research on vermicompost and worm teas were conducted by comparing results of growth, yield, and chemical properties of soil by conducting experiments with economic crops i.e. banana (Khatua et al., 2018), carrot (Rao et al., 2017), cucumber (Najjari and Ghasemi, 2018), marigold (Atiyeh et al., 2002), petunia (Arancon et al., 2008), potato (Singhai et al., 2011), strawberry (Singh et al., 2008), tomato (Atiyeh et al., 1999; Atiyeh et al., 2002). In United States of America, the experiments were conducted by comparing among traditional compost, vermicompost mixed with soilless commercial growth medium called Metro-Mix (MM360). Results of (Atiyeh et al., 2002) suggested to apply 5% of vermicompost substituted into MM360 for growth response. Vermicompost from cow manure provided more desirable effect when compare with leaf meal and leaf meal combined with cow manure by having results with high C/N , percent of organic matter, organic carbon, N, P, K, and micro nutrients (Fe, Cu, Zn, Mn). Maximum concentration of N, P, K (2.31%, 1,862.32 mg/L and 2,482.3 mg/L, respectively) were in the vermicompost tea produced from cow manure (Zarel et al., 2017).

Marigold has become global economic crop for a long time. Origin of marigold flower is native to North and South America (New Mexico to Argentina) and now popular around the world. Botanical name is Tagetes. There are 56 species in the Tagetes genus. In Asian countries, marigolds are used for various purposes i.e. religious worship (Marigold Asia, 2018). Planted marigold species in Thailand are

American marigolds, French marigolds, and Mule marigold (or Afro American marigolds). They are planted mainly in north and northeast for 9,500 Rai (15.2 km^2) and exported for 7.2 million baht per year (Suradej, 2018). Demand of marigold flowers was high in 2017 because Thai people used yellow marigolds in honor of the late king (Fredrickson, 2017). The marigold has been selected to test in this study because of short period growing for 60-65 days since seeding to flowering, easy-to-grow, and low maintenance.

Several researchers have determined influence of vermicompost on the growth and productivities of marigolds. The pig manure vermicompost substituted in Metro-Mix 360 with 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% (by volume) for growing French marigold. Maximum growth and production of marigold was found in 40% pig manure vermicompost (Atiyeh et al., 2002). In Thailand, application of vermicompost and vermicompost tea for marigold have been studied by Nilawonk (2014). The earthworm was fed by vegetable waste. The experiments were conducted to compare among non-fertilizer, inorganic fertilizer (50-22-42 kg/ha), vermicompost (6.25 t/ha) and worm tea (50 ml per plant), vermicompost (6.25 t/ha), and vermicompost (3.125 t/ha) and inorganic fertilizer (25-11-21 kg/ha). The results suggested that vermicompost had good potential to substitute inorganic fertilizer because of high amount of organic matter 15.85%, total N 0.8%, P 0.63%, K 1.44%, Ca 1.77%, Mg 5.10%, increasing number of marigold flower 45.3 flowers per plant (50 cm x 50 cm plot size), fresh flower weight 60 g, stem length 10.5 cm. Moreover, vermicompost provided good chemical properties of soil with pH 6.5 when applied in the soil. There are some local research on worm tea in Thailand indicated that it can enlarge marigold flower size by using African night crawler (Buaplee, 2018). There are several studies indicated that vermicompost from cow manure contains high nutrient and improve soil quality but there is no research of vermicompost tea from cow manure vermicompost on marigold, which is economic crop that tends to be planted more in the future because of its beauty and good meaning so there is high demand for religious worship, election, and ceremony in remembrance of His Majesty the Late King Bhumipol Adulyadej. This study focused influence of vermicompost teas from cow manure on marigold growth and yield to reduce solid waste, and reduce chemical application.

Materials and Methods

The vermicompost has originated from farmers at Saraburi province. Local vermicompost products have been promoted by local administration. Two species of worm were African Night Crawler (AF) (*Eudriluseugeniae*) and European Night Crawler (Euro) (*Eiseniahortensis*). The AF vermicompost was available at Muang Ngam district and the Euro vermicompost was available at Nhong Sang district. The major difference between AF and Euro worms is size of their body. Size of the AF worms is 130-250 mm length and 5-8 mm width, while size of the Euro worms is 35-130 mm length and 3-5 mm width. Bigger size of body has result in bigger size of excretion. Both AF and Euro worms were fed by cow manure, which was solid waste in the community. There

were three treatments consisted of i) control (water supply), ii) vermicompost tea from AF worms, and iii) vermicompost tea from Euro worms

The experiment was conducted at Valaya Alongkorn Rajabhat University under the Royal Patronage in April 2018. The vermicompost teas were prepared by mixing 500 g of vermicompost and 50 ml of molasses aerated in 5-liters of water for 7-15 days. Dilution of vermicompost tea is 10 percent. The vermicompost teas' dilution was applied for 500 ml every day in treatment ii and iii. The water supply was applied for 500 ml in treatment i. Each treatment was carried out for three pots of marigold. In each pot contained one marigold tree. Three replications were performed to record height, grit, and number of marigold flowers. The data was recorded at 0, 3, 6, 9, 12, and 15 days of the experiment.

Statistical Analysis of the entire experiment was done using a completely randomized design (CRD) method. Marigold growth and production for 3, 9, 12 and 15 days was calculated by Statistic 8 software (version 8, USA). Standard error of mean value (SEM) of replication sampling (n=3) was taken for each analysis. A significantly different result

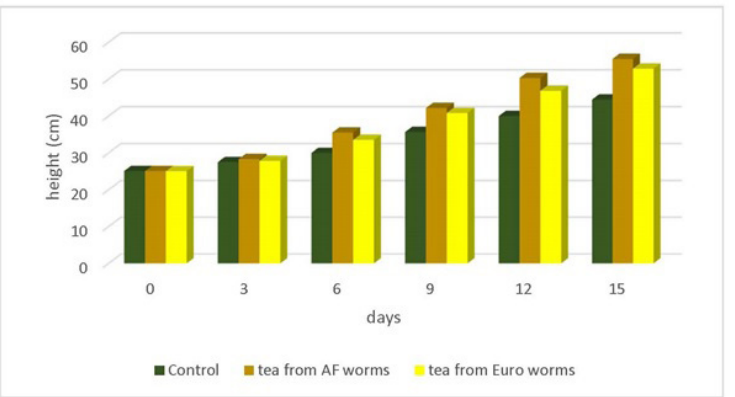

Figure 1 Marigold's height results of water supply, AF, and Euro vermicompost tea application.

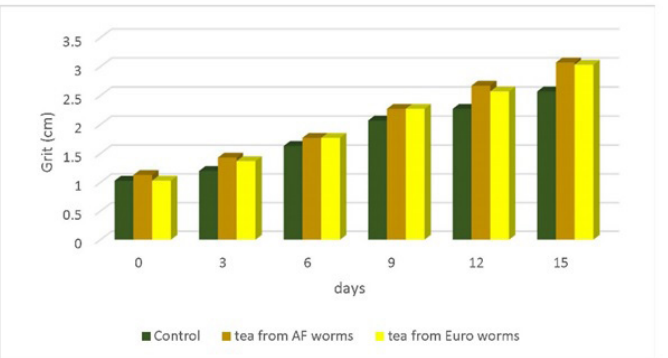

Figure 2 Marigold's grit results of water supply, AF, and Euro vermicompost tea application.

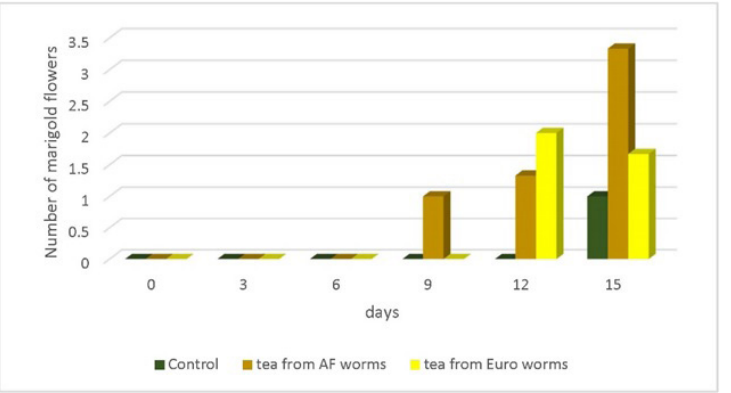

Figure 3 Number of marigold flower results of water supply, AF, and Euro vermicompost tea application.

was established by a one-way ANOVA, and mean comparisons of different treatments were carried out by least significant difference (LSD) on Duncan multiple test of Statistix 8 Software (Analytical Software, Tallahassee, FL). The acceptance level of significance was of a probability value less than 0.05 ($p<0.05$).

Results

Average results of marigold growth and production are presented in Figures. 1-3.

From Figures 1-3, the maximum height, grit, and number of flowers were presented in treatment ii that vermicompost tea of AF worms was applied. The maximum height of marigold trees that has been applied by vermicompost tea were 55.50±1.08 cm (AF worm tea) and 52.83±1.43 cm (Euro worm tea), which were higher than control treatment at 44.47±0.41 cm. The results of maximum grit were 2.57±0.09 cm, 3.07±0.09 cm, and 3.03±0.05 cm for control, AF worm tea, and Euro worm tea, respectively. Number of marigold flowers were 0-2 flowers, 3-4 flowers, 1-2 flowers in each pot of treatment i, ii, and iii, respectively.

Discussion

The results of this study are the same as other studies i.e. Pimolpan Promthong (Buaplee, J., 2018) that vermicompost tea can gain growth and yield of marigold. The growth of marigold trees that applied vermicompost tea were higher than marigold trees that were watering by water. In this study, the maximum height of marigold trees in control case (water application) were 44.47±0.41 cm, which were the same range as 35-47 cm that applied marigold by soil and municipal solid waste with water application (Chuleemas Boonthai IWAI et al., 2013). Therefore, it is confirmed that the height of marigold on vermicompost tea application at 55.50±1.08 cm (AF worm tea) and 52.83±1.43 cm (Euro worm tea) have results in higher growth of marigold than usual. Among application by water supply, vermicompost tea of AF worms, and vermicompost tea of Euro worms, maximum growth and yield of marigold was found in applying vermicompost tea that originated from the AF worms. The reason of this maximum growth and yield of marigold because of nutrient transformation from

cow manure to the earthworms. The African Nightcrawler size was bigger and more active than European Nightcrawler so it has more ability to transform nutrients from the waste to themselves. Therefore, the vermicompost from the AF worms contained more nutrients than those of the Euro worms. The vermicompost tea from the AF worms contained high organic nitrogen resulted in high growth and high phosphorus resulted in a large number of marigold flowers production.

Biological waste can be reduced by using the cow manure as food for feeding worms. Moreover, other biological waste can be applied for feeding worms i.e. pig manure (Atiyeh et al., 2002; Arphon Thongburan and Chuleemas Boonthai IWAI, 2018), chicken manure (Nattakit Petmuenwai et al., 2016), cassava peel (Arphon Thongburan and Chuleemas Boonthai IWAI, 2018), rice husk ash (Arphon Thongburan and Chuleemas Boonthai IWAI, 2018), coconut coir fiber (Peeryut Sirithanakorn et al., 2014), water hyacinth (Peeryut Sirithanakorn et al., 2014), banana tree (Peeryut Sirithanakorn et al., 2014). Applying of vermicompost tea can also reduce chemical fertilizer application, which is sustainable agricultural practice that produce safe products for humans and keep good environment.

Conclusions

The vermicompost teas prepared from vermicopost of African Night Crawler (AF) and European Night Crawler (Euro) fed by cow manure can gain growth and yield of marigold. Therefore, application of vermicompost tea on marigold should be promoted to farmers because it can gain growth and yield of marigold flower, reduce solid waste, and reduce chemical application.

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