EFFECT OF *CHROMOLAENA ODORATA* AS ORGANIC FERTILIZER ON *GLYCINE MAX* (L.) MERRILL.

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Abstract

Chromolaena odorata (L.) R. M. King & H. Robiston; which was belong to the family Asteraceae and locally known as Bezat or Jamani-chon in Myanmar. The plant was collected in Mohnyin University Campus, Kachin State from June 2022 to September 2022. The collected specimen have been taken photographs and dried at room temperature for one month. The dried samples were ground in grinder to get fine powder. Experiments using a randomized complete block design (RCBD) with five replications were carried out. This study investigated the effect of various *Chromolaena* suspension on the growth and development of soybean during 2022 to 2023. The seed of soybean cultivar Y15 were tested with *Chromolaena* suspension and experimentally studied in laboratory and pot culture. Among the five different kinds of *Chromolaena* suspension treatment, the *Chromolaena* suspension 4 gL^{-1} and 6 gL^{-1} were best for growth and development of Soybean Y15 cultivar. In pot culture *Chromolaena* suspension 4 gL^{-1} and 6 gL^{-1} were much more effective in enhancement of plant height and leaf area than other treatment and control. The result showed that *Chromolaena* suspension actually promotes the growth and development of soybean Y15 variety.

Keywords: *Chromolaena odorata*, suspension, organic fertilizer

Introduction

Soybean is one of the most important food plants world-wide grown as an industrial and versatile crop (Afework & Adam, 2018; Shea *et al.*, 2020). Global soybean production reached 358 million metric ton in 2019 with American producing 95 million metric tons in 2019. Brazil produced 123 million metric tons of soybean in 2019 and became a world record. They are followed by Argentina, China, India, Paraguay, Canada, Mexico and some European countries in the list of highest soybean producers. The mean protein content in these trials (41.6%) was comparable to the global average protein content, for example, Brazil (40.9%), USA (41.4%) and China (42.1%). The oil content in the trials (19.1%) was higher than the oil content in Brazil (18.7%), USA (18.8%) and China (16.8%) (Grieshop and Fehey, 2001).

Soy-based nutritious food products such as tofu, soymilk, soy sauce, miso, etc. have been developed for human consumption while oil extracted soy meal is used as a nutritious animal feed. Besides its use for domestic purposes, soy oil finds multifarious uses in industries related to production of pharmaceuticals, plastics, papers, inks, paints, varnishes, pesticides and cosmetics. Recently, use of soy oil as biodiesel has opened up another possibility of renewable sources of energy for industrial uses. Soybean occupies a premier position among agricultural crops, being the most important source of good quality concentrated proteins as well as vegetable oil. Seeds of soybean used in Asia and other part of world for many centuries to prepare a variety of fresh, fermented and dried foods (Probst and Judd 1973).

Myanmar is an agricultural country bordering China a part of the Belt and Road Initiative and that has the potential to penetrate the large soybean market and enter the global stage. This is why we need to make effective preparation for soybean production. We can divide this into cultivation, industrial processing, and quality aspects. Soybean seeds have been put to a wide range of uses throughout the world, partly because of its high nutritional values and partly for its good

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quality oil. Moreover, soybean oil is used for salad, dressing, cooking and margarine. Therefore, the improvement of soybean production becomes an important section in both tropical and temperate countries. Soybean is the most important source of food and feed, versatile crop and produces an abundant supply of protein and oil (Yin Yin Thant 2008).

Fertilizer supply nutrients needed by crops. Fertilizers can produce more food and cash crops of better quality. Natural organic fetilizer (Biofertilizer) that helps to keep in the soil with all nutrients and living required for the benefits of the plants. Therefore, agricultural scientists have been suggested that biofertilizer shoul be used in place of chemical fertilizer, to avoid long-term negative effects of chemical fertilizer on the soil (Parr *et al.,* 1990).

Chromolaena odorata is a perennial succulent or semi-woody shrub belonging to the Asteraceae family or Compositae (known as the aster, daisy, or sunflower family) is the largest family of flowering plants represented by about 950 genera and 20,000 specxies over the globe (Mahbubur 2013). The common name for these plants are Siam weed, devil weed, epatorium, Jack-in-the bush, king weed,paraffin weed (Vijayaghavan et al., 2017).

C. odorata shoot contains 1.26% Nitrogen, 0.67% Phosphorous, 1.08% Potassium, 2.33% Calcium and 0.005% Magnesium (Olabode *et al*., 2007). *C.odorata* grows in wild bushes without any organized cultivation. Indeed, it is considered to be a weed in most farming systems. Siam weed biomass has a reasonably high nutrient content (2.56% N, 0.38% P, 2.41 % K). Siam weed has grown wild had the potential to be used as a source of organic materials for the production of high biomass (Ojeniyi *et al*., 2012). Siam weeds are very difficult to control and cause many problems in various agriculture and plantations (Karian *et al*., 2017).

Chromolaena odorada leaves were also a rich source of mineral elements such as Ca, Na, K, Fe, Mn, Zn, Cu, P and Mg. Leaves also yield alkaloids, flavonoids, saponins, cyanogenic glycosides, tannins and phytic acid (Nwinuka, *et al*., 2008)

Chromolaena plant biomass possess good microbial association in the rhizosphere and upon using this in compositing and supplying to the main field would favor good growth by encouraging useful microbes in soil. Further, use of weed composts also enhances the soil organic carbon which helps in increasing plant growth promoting rhizobacter in the soil. These were known to produce phytohormones and vitamins apart from nitrozing fixing by free living microbes organisms to the growing crop plants. All these biological features improved plant high, leaf number and biological factors by using weed composed favoured the soil chemical and biological properties which lead to higher nutrient uptake by the crop. All these resulted in higher agronomic efficiency of applied nitrogen. (Kumar, 2004)

The aim of the present study was to test the effects of application of organic fertilizer in various rates on growth and development. The objective of this research were to study the effect of *Chromolaena odorata* suspensions as organic fertilizer on soybean and to determine the importance suitable dose of organic fertilizer application in order to improve growth and development.

Materials and Methods

Laboratory Experiment

Collection of the *Chromolaena odorata* (L.) plants had been done from Mohnyin University Campus, Kachin State from June 2022 to September 2022. The collected specimens were taken photographs, and dried at room temperature allowed to keep one month. The dried samples were grounded in a grinder to get fine powder. Various weights (2g, 3g, 4g, 5g and 6g) of plant powder were mixed in pure water for 24 hours, and then different concentration of suspensions were obtained.

Laboratory experiment with *Chromolaena odorata* Suspesion

The soy bean seeds were soaked in pure water and mixed with different percentages of *Chromolaena odorata* powder T_1 (2%), T_2 (3%), T_3 (4%), T_4 (5%) and T_5 (6%).

Pot Experiment

Experiments were conducted at Mohnyin University Campus from December 2022 to March 2023. In this experiment, soybean seeds were presoaked in various concentration ($2gL^{-1}$, $3gL^{-1}$, $4gL^{-1}$, $5gL^{-1}$ and $6gL^{-1}$) of *Chromolaena* suspension for 24 hours. Control was soaked in water for 24 hours. In the experiments Randomized Complete Block Design (RCBD) was used with five replications. The soil was sterilized under the sun for 3 days. The prepared soil was placed into the polyethylene (PE) bags. Each seed was placed in PE bag. Each soybean cultivars were included 30 PE bags and each bag was consisted one seed.Each treament was regularly watered with 500 ml once a day.

Pot Experiment Design Randomized Complete Block Design (RCBD)

Replication – 5

Control = T0 = $0\ gL^{-1}$(C) Cultivar Yezin -15

Treatment = T1 = $2gL^{-1}$

T2 = $3gL^{-1}$

T3 = $4\ gL^{-1}$

T4 = $5\ gL^{-1}$

T5 = $6\ gL^{-1}$

Experimental Layout (CY_{15})

C T_4	C T_2	C T_0	C T_1	C T_5	C T_3
C T_2	C T_0	C T_5	C T_3	C T_4	C T_1
C T_5	C T_1	C T_3	C T_4	C T_2	C T_0
C T_3	C T_4	C T_5	C T_0	C T_1	C T_2
C T_0	C T_5	C T_2	C T_4	C T_3	C T_1

Results

Morphological Characters of *Glycine max* (L.) Merrill.

Family name	:	Fabaceae
Scientific name	:	*Glycine max* (L.) Merrill.
English name	:	Soybean, Soya
Myanmar name	:	Peboke
Flowering period	:	July to September

Annual herbs, about 1m high; stems and branches terete, gray-brownish hairy. Leaves trifoliolate pinnately compound; stipules acute, about 3 mm long, pubescent, persistent; petioles terete, furrowed above, 12.5- 2.0 cm long. pubescent; stipels setaceous, 1.0- 3.0 mm long, pubescent, persistent; leaflets broadly ovate, 7.0- 12.0 cm by 4.0- 7.5 cm, pubescent with lax hairs to glabrescent, cuneate or rounded at the base, entire along the margin, acute or occasionally obtuse at the apex. Inflorescence axillary raceme, few-flowered, usually 1-flower at a node. Flowers bisexual. zygomorphic, about 0,5 cm in diameter, purple; bracts lanceolate, striate, 4.2- 5.5 mm long, bracteoles linear-lanceolate or setaceous, 2.0 - 3.0 mm long; pedicels short., Calyx tubular, 5-lobed; tube about 0.3 mm long, lobes acute-acuminate, about 0.3 mm long. glabrous within, villous without. Corolla papilionaceous, exserted; standard squarish, orbicular, about 5.0 mm by 5.0 mm; wing obovate to oblong, 5.0 - 7.0 mm by 2.0- 3.0 mm; keel oblong, about 4 mm long, pale purple, glabrous. Stamens 10, diadelphous; filament filiform, about 3 mm long, white, glabrous; anthers ovoid, about 1mm long, dithecous, basifixed, dehiscent by longitudinal slit. Ovary oblong. about 2.0 mm long, green, pubescent; style short, about 1 mm long, white, pubescent, stigma simple. Fruits pod, oblongoid, 2.5- 5.0 cm by 0.8- 1.0 cm, green, yellowish- brown when ripen, bristly hairy. Seeds globose, glabrous, pale yellow. (Figure 1, E,F)

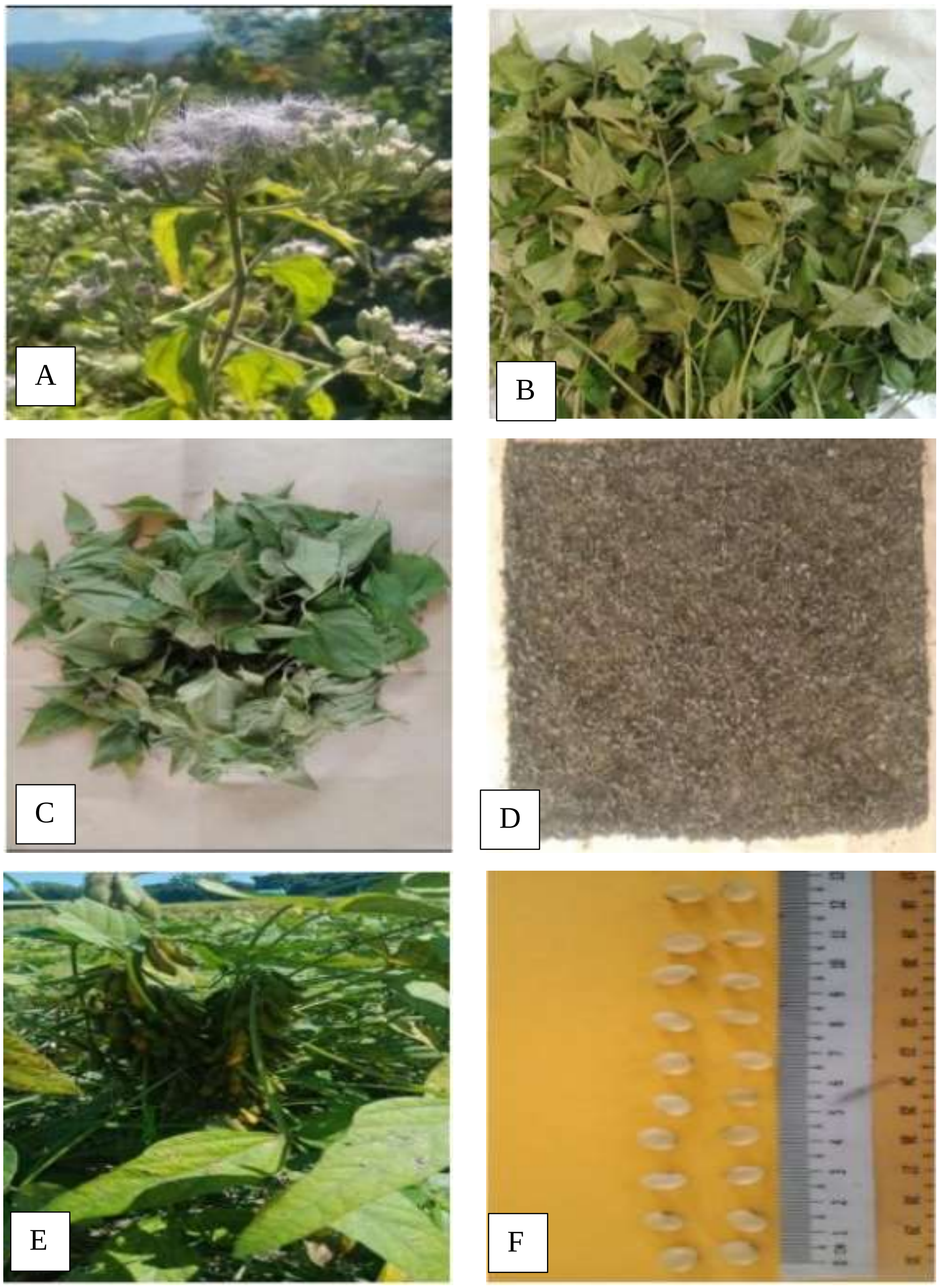

Figure 1. Morphological Characters of *Chromolaena odorata* (L.) and *Glycine max* (L.)

A. Habit of *chromolaena odorena*
B. Stems and Leaves
C. Leaves of *Chromolaena odorena*
D. Dry Leaves of *Chromolaena odorena*
E. *Glycine max*
F. Y 15 Seeds(*Glycine max)*

The results show that doses of *Chromolaena odorata* suspension significantly affected of the plant growth and development. In addition, *Chromolaena* suspension at a dose of 4gl^{-1}/pot and 6gl^{-1}/pot produced higher plant height, leaf size , length of petiole and number of pods compared to other treatments and control. (Table 1, 2, 3, 4)

Table 1. The effect of *Chromolaena odorata* suspension on plant height of soybean cultivar (Yezin-15) at different sampling dates

Treatments	1 Week	2 Week	3 Week	4 Week	5 Week	6 Week	7 Week
T1 (2 g l^{-1})	6.15 ab	10.50 bc	15.84 cd	18.01 c	24.55 c	27.40 cd	27.50 cd
T2 (3 g l^{-1})	6.20 ab	11.35 abc	16.75 bc	19.30 bc	26.10 bc	28.90 bc	29.05 cd
T3 (4 g l^{-1})	6.30 ab	11.65 ab	17.40 b	19.97 b	27.55 b	30.20 ab	30.95 b
T4 (5 g l^{-1})	6.45 a	10.80 abc	15.70 cd	18.85 bc	26.35 bc	28.60 bcd	29.35 bc
T5 (6 g l^{-1})	6.65 a	12.10 a	19.70 a	22.00 a	30.05 a	31.70 a	33.05 a
T0(control)	5.80 b	10.25 c	15.00 d	17.80 c	24.15 c	27.20 d	27.35 d
F-Test	n.s	n.s	**	**	**	**	**
LSD (5%)	0.60	1.39	1.35	1.63	2.34	1.62	1.89
CV%	7.32	9.49	6.13	6.40	6.71	4.22	4.86

n.s = (> 0.05) Non- Significant, * = Significant at 5% (≤ 0.05), ** = Significant at 1% (≤ 0.01)

Table 2. The effect of *Chromolaena odorata* suspension on leaf size of soybean cultivar (Yezin-15)

Treatment	First Leaf		Second Leaf	
	Length (cm)	Wide (cm)	Length (cm)	Wide (cm)
T1 (2 g l^{-1})	3.89 ab	2.53 bc	3.38 cd	1.97 bc
T2 (3 g l^{-1})	4.29 a	2.81 a	3.66 bc	2.14 b
T3 (4 g l^{-1})	4.33 a	2.75 ab	4.02 ab	2.22 ab
T4 (5 g l^{-1})	4.17 ab	2.80 a	3.67 bc	2.11 bc
T5 (6 g l^{-1})	4.26 a	2.88 a	4.37 a	2.43 a
T0(control)	3.74 b	2.44 c	3.08 d	1.83 c
F-Test	n.s	*	**	* *
LSD (5%)	0.49	0.27	0.57	0.29
CV%	9.00	7.52	11.70	10.38

n.s = (> 0.05) Non- Significant, * = Significant at 5% (≤ 0.05), ** = Significant at 1% (≤ 0.01)

Table 3. The effect of *Chromolaena odorata* suspension on leaf size of soybean cultivar (Yezin-15)

Treatment	Third Leaf		Fourth Leaf		Fifth Leaf		Sixth Leaf	
	Length (cm)	Wide (cm)	Length (cm)	Wide (cm)	Length (cm)	Wide (cm)	Length (cm)	Wide (cm)
T1 (2 g l^{-1})	3.74 cd	2.21 bc	3.31 c	1.97 bc	4.550 c	2.45 c	3.92 c	2.20 bc
T2 (3 g l^{-1})	4.05 bcd	2.45 abc	3.56 bc	2.08 bc	5.40 ab	2.92 ab	4.58 a	2.38 b
T3 (4 g l^{-1})	4.39 ab	2.55 ab	3.99 ab	2.19 b	5.26 ab	2.82 ab	4.22 abc	2.60 a
T4 (5 g l^{-1})	4.29 abc	2.58 ab	3.87 ab	2.10 b	4.92 bc	2.74 bc	4.07 bc	2.37 b
T5 (6 g l^{-1})	4.81 a	2.84 a	4.39 a	2.52 a	5.46 a	3.16 a	4.47 ab	2.66 a
T0(control)	3.57 d	2.10 c	3.24 c	1.80 c	4.66c	2.45 c	3.82 c	2.13 c
F-Test	**	*	**	**	**	**	*	**
LSD (5%)	0.5706	0.40	0.55	0.30	0.49	0.37	0.46	0.22
CV%	10.44	12.48	11.13	10.58	7.37	10.06	8.34	6.85

n.s = (> 0.05) Non- Significant, * = Significant at 5% (≤ 0.05), ** = Significant at 1% (≤ 0.01)

Table 4. The effect of *Chromolaena odorata* suspension on petiole and number of pod per plant of soybean cultivar (Yezin-15)

Treatment	First Petiole	Second Petiole	Third Petiole	Fourth Petiole	Fifth Petiole	Sixth Petiole	Pods/plant
	Length (cm)	Length (cm)	Length (cm)	Length (cm)	Length (cm)	Length (cm)	
T1 (2 g l^{-1})	0.89 cd	4.35 cd	5.50 b	6.65 b	3.87ab	2.57bc	8.80 b
T2 (3 g l^{-1})	1.09 abc	5.05 bc	5.20 b	8.00 a	4.29a	2.75ab	10.80 ab
T3 (4 g l^{-1})	0.99 bcd	5.40 b	6.65 a	7.90 a	4.34a	2.81a	12.60 a
T4 (5 g l^{-1})	1.17 ab	5.15 b	6.70 a	7.80 a	4.17ab	2.80a	10.80 ab
T5 (6 g l^{-1})	1.26 a	6.45 a	7.00 a	8.05 a	4.26a	2.88a	13.40 a
T0(control)	0.75 d	4.25 d	5.15 b	6.52 b	3.73b	2.43c	7.80 b
F-Test	**	**	*	*	n.s	*	**
LSD (5%)	0.26	0.70	0.10	0.98	0.49	0.27	3.03
CV%	19.22	10.40	12.51	9.91	9.00	7.52	21.4

n.s = (> 0.05) Non- Significant, * = Significant at 5% (≤ 0.05), ** = Significant at 1% (≤ 0.01)

Discussion

Application of *Chromolaena odorata* residues is expected to benefit both the soil and the crop. The soil was predominantly sandy and slightly acidic, low in nitrogen content, two phosphorus content and a high quantity of potassium (Ogundare *et al.* 2013)

Ogundare (2011) reported that combination of *Chromolaena odorata* residues and mineral fertilizer (Urea) showed promising potential in conserving soil fertility and improve the yield of maize in the study area. The better maize growth observed for *Chromolaena odorata* residues plus were fertilizer. The effects of *Chromolaena* residues and urea fertilizer on yield and yields components maize. (Ogundare *et al.* 2015)

The application of *C. odorata* weed compost at various doses resulted in higher total nitrogen available P, and available K when compared to N.P.K. Phonska treatment and without fertilization. In addition, *C odorata* weed compost at a dose of 666 grms/pot produced higher nitrogen uptake, phosphate leaf, and leaf potassium compared to other treatment *C. odorata* at a dose of 444 grams/ pot gave the highest content of nitrogen, phosphate, and potassium in Lettuce plants. Compared to inorganic fertilizer, cow manure, and without fertilizer treatments. (Alima Prapto, 2020). Siam weeds compost application of 20 tons ha^{-1} can substitute urea of 200 kg ha^{-1}, while increasing the yield of chili paper (Setyowati *et al*., 2014). The application of Siam weed compost of 10 tons ha^{-1}showed the highest yield in upland rice by 2.97 tons ha^{-1} and increase yield by 91.75 % compared to without application of Siam weed compost (Suryanto *et al*, 2020)

Chromolaena odorata is an invasive plant the potentially organic manure. This factors examined were doses (2, 3, 4, 5 and 6 gl^{-1}). The result showed that the *Chromolaena* suspension was more effective than control. The application of *Chromolaena suspension* 4 gl^{-1} and 6 gl^{-1} give more effective than other treatment and control. The optimum dosage of *Chromolaena* suspension application for soybean were 4 gl^{-1} and 6 gl^{-1}, respectively, with a maximum growth and development.

Finally, according to the present study, the utilization of Chromolaena suspension as a natural fertilizer which is not harmful to both living things and environment have been established.

Conclusion

From the present investigation, it can be concluded that *Glycine max* (L). Merr. Soybean cultiver (Y15) gave the recommended dose of *Chromolaena* suspension T3 (4 gL^{-1}) and T5 (6 gL^{-1}). The application of *Chromolaena* suspension significitly increased plant growth and development. *Chromolaena* suspension at a dose of 4gL^{-1} and 6 gL^{-1} gave the highest growth and development in soybean plants compared to control. Thus it is suggested that *Chromolaena* suspension is one of the most important tools production and for maintaining soil productivity. It is recorded that their treatments with organic fertilizer have higher values when it is compared to without fertilizer.

Enhancement of growth and yield of soybean by *Chromolaena* suspension treatment indicates that *Chromolaena* acts as a fertilizer similar to chemical fertilizers. Free availability of *Chromolaena* to farmers would greatly reduce cost of crop production and also lower cost of products for consumes.

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