

**The ratio of fine textured soil mixed
with sponge stone fertilizer types on
growth, nutrient concentration
and some soil properties in
marigold plantation**



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Introduction

Raw material
360 tons/month
(90%)

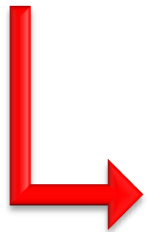


Glass
400
tons/month
(100%)



Sponge stone

Waste
40 tons/month
(10%)

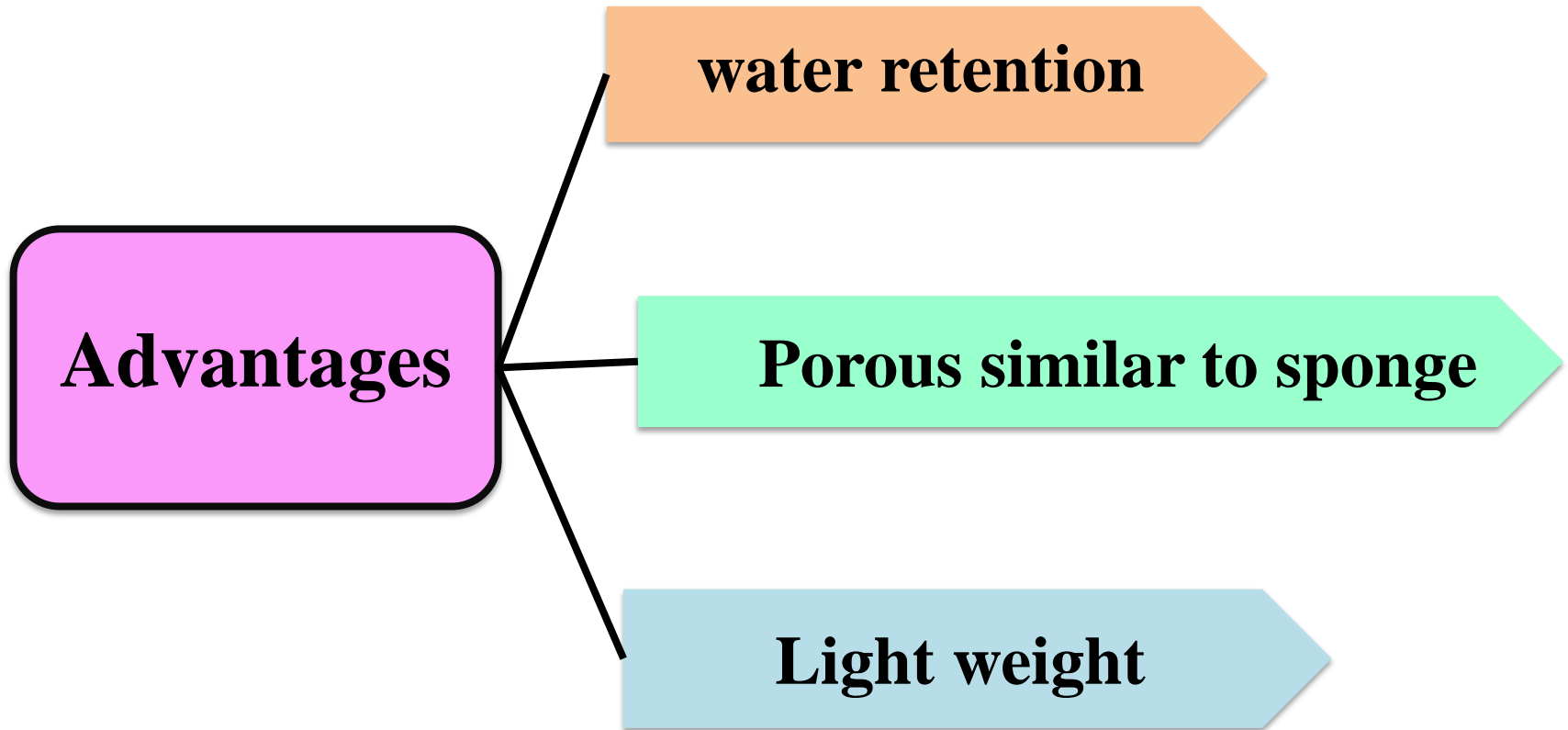


Value added





Introduction





Introduction

➤ Chaiwat (2015) reported that sponge stone can water retention in coarse-textured soils.

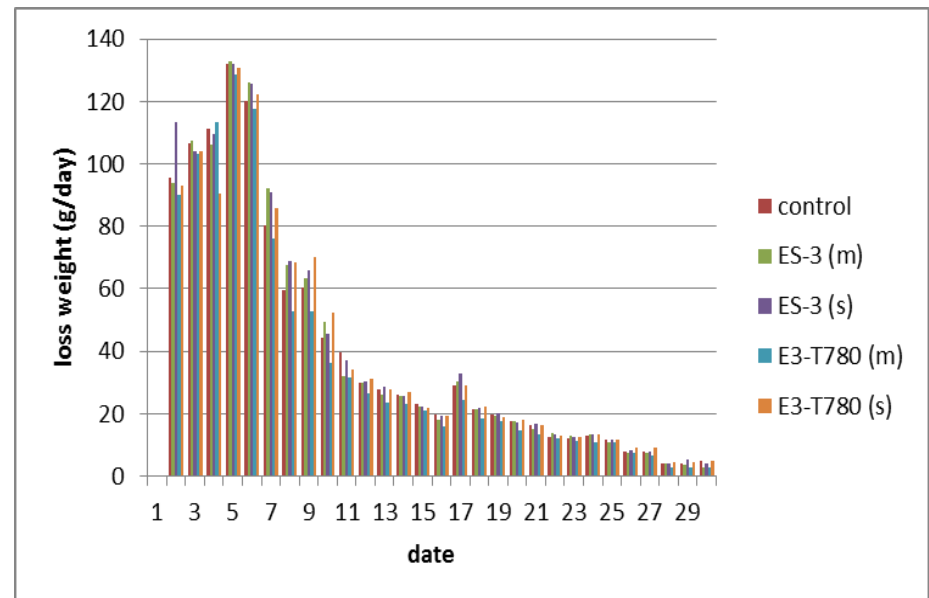


Figure 1 Loss weight (g day^{-1}) of water retention in soil.



Introduction

➤ Suree (2015) reported that sponge stone can reduce the soil surface evaporation in coarse- textured soils.

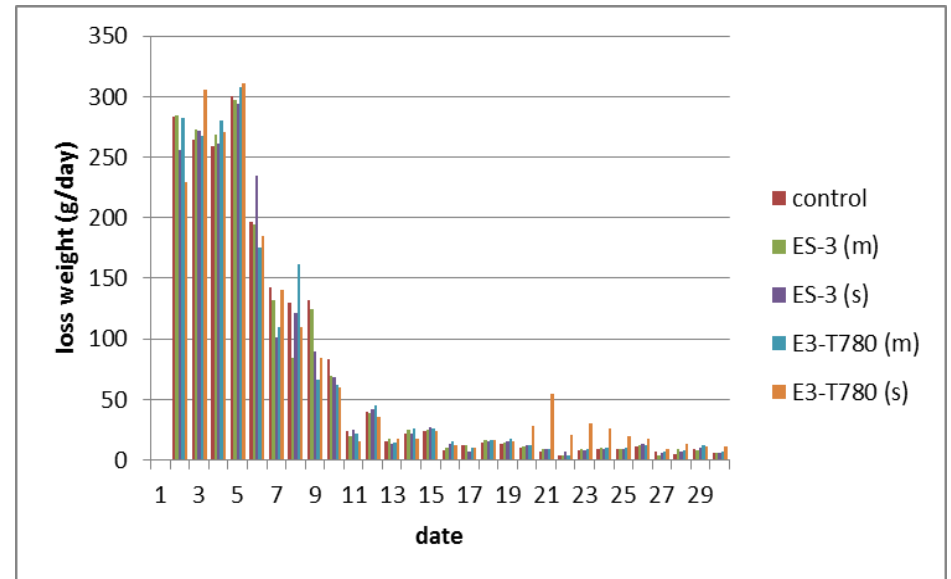


Figure 2 Loss weight (g day^{-1}) of water retention in soil.



Introduction

- Pornphimon (2017) reported that sponge stone of fertilizer type(15-15-15) mixed with fine texture soil can released the plant nutrient.

➔ Total N at 9 days

➔ Available P at 9 days

➔ Exchangeable K at 21 days

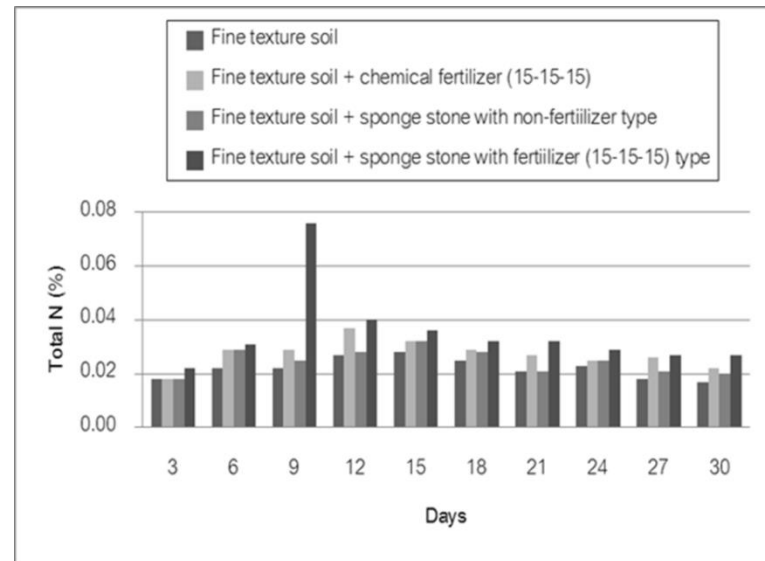


Figure 3 Effect of sponge stone on total nitrogen release in fine texture soil



Introduction



Floriculture area: 77,000 rai

Export: 20th in the world (3,478 million baht)



Introduction



Marigold (*Tagetes erecta* L.)

Plantation area: 9,500 rai; Phayao, Lampang, Nonthaburi, Ratchaburi, Suphanburi, Samut Sakhon, Bangkok and Udonthani



Introduction

➤ Jiraporn(2017) reported that sponge stone mixed with medium soil textured enhanced the plant growth and plant nutrient accumulation in marigold. Then, sponge stone combine with soil (1:2 and 1:4 by volume) can be used for growing media in marigold plantation.





Introduction

Pak Chong series (Pc)



- ❖ **Very fine**, kaolinitic
- ❖ Residuum and local colluvium from limestone and occur on the karst topography
- ❖ **Well drained soils**
- ❖ **Permeability is moderate**
- ❖ Runoff is rapid to medium



Objective

To study the ratio of sponge stone with fine texture soil on the growth, nutrient concentration and some soil properties in marigold.





Materials



Table 1. Some soil properties in Pak Chong series at 0-30 cm

Soil properties	Values	Means
Soil pH (1:1)	6.2	slightly acid
Soil organic matter (%)	0.8	low
Available P in soil (mg/kg)	3.0	low
Exchangeable K in soil (mg/kg)	18.0	low
Exchangeable Na in soil (mg/kg)	46.4	low
Extractable Si in soil (mg/kg)	10.8	low
Soil texture (sand 5.4%, silt 19.1% and clay 75.5%)	Clay	fine texture



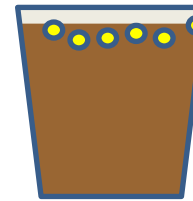
Method

Experiment design : Completely Randomized Design (CRD)
with 8 replications and 4 treatments



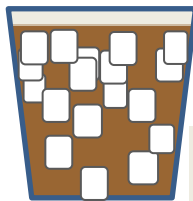
TR 1.

control



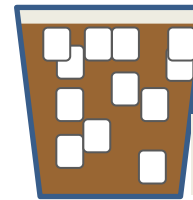
TR 2.

soil + chemical fertilizer



TR 3.

soil + sponge stone
(2:1 v/v)



TR 4.

soil + sponge stone
(4:1 v/v)

*  = Sponge stone of 15-15-15 fertilizer type ,  = chemical of 15-15-15 fertilizer type

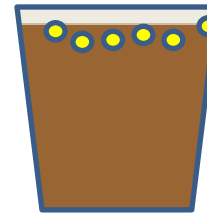


Method



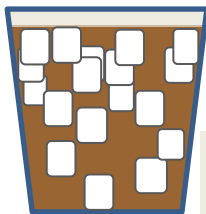
TR 1.

soil 12 L/pot



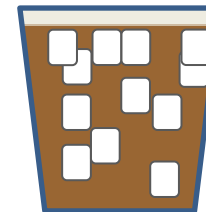
TR 2.

soil 12 L/pot + chemical fertilizer
2 g/pot



TR 3.

soil 8 L/pot + sponge stone
(fertilizer type) 4 L/pot



TR 4.

soil 9.6 L/pot + sponge stone
(fertilizer type) 2.4 L/pot



Method



0 day

**1 L/cell tray
everyday**



14 days after sowing

**all treatment :
water applied
at 250 ml/pot**



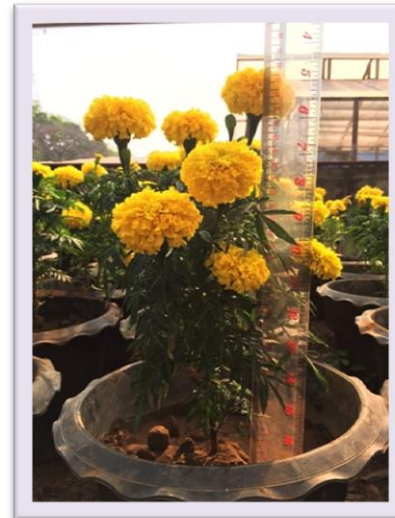
Data collection

Plant growth

- plant height (cm)
- Fresh weight (g)
- Dry weight (g)

Flower quality

- Number of flower
- Flower size (cm)





Data collection

Plant analysis

- a. Total N (g/kg DW)
- b. Total P (g/kg DW)
- c. Total K (g/kg DW)

Soil analysis (0-10 cm)

- a. Total N (%)
- b. Available P (mg/kg)
- c. Exchangeable K (mg/kg)

Two vibrant yellow marigold flowers with green stems are positioned behind the text. The flowers are in full bloom, showing many small, ruffled petals. The stems are green and cross each other in the center.

Results and Discussion

Table 2 Plant height of marigold at 7,14, 21, 28, 35, 42 and 49 DAT.

Treatments	Plant height (cm) at day after transplanting (DAT)						
	7	14	21	28	35	42	49
soil (control)	5.7 b	8.0 c	10.0 b	13.7 b	18.7 b	19.3 b	20.3 b
soil + chemical fertilizer	7.0 a	12.0 a	14.7 a	19.0 a	23.0 a	26.3 a	28.0 a
soil + sponge stone (2:1)	6.2 b	10.3 b	16.3 a	20.3 a	24.7 a	26.7 a	29.3 a
soil + sponge stone (4:1)	6.0 b	9.7 b	14.3 a	19.3 a	24.0 a	26.7 a	29.3 a
F-test	**	**	**	**	**	**	**
CV. (%)	10.86	12.00	13.43	13.82	14.40	14.20	14.16

Values followed by the same letter in a column are not significant at 1% ($p>0.01$), DMRT.

** Significantly different at $p<0.01$.



Figure4 Effect of sponge stone on plant growth of marigold at 42 DAT

Table 3 Plant dry weight flower number and flower size of marigold at 56 DAT.

Treatments	Dry weight (g)	Flower number	Flower size (cm)
soil (control)	4.10 c	4 b	5.41 b
soil + chemical fertilizer	14.29 b	10 a	5.72 ab
soil + sponge stone (2:1)	15.50 a	9 a	6.22 a
soil + sponge stone (4:1)	15.02 a	9 a	5.83 ab
F-test	**	**	*
CV.(%)	13.92	15.18	14.76

Values followed by the same letters in a column are not significant at 5% ($p>0.05$) and 1% ($p>0.01$) levels, DMRT. *,** Significantly different at $p<0.05$ and $p>0.01$.

Table 4 Total N P and K concentration in plant (g/kg DW) of marigold at 56 DAT

Treatments	Total N (g/kg)	Total P (g/kg)	Total K (g/kg)
soil (control)	8.94c	0.006d	12.42d
soil + chemical fertilizer	49.88b	0.039c	36.36c
soil + sponge stone (2:1)	65.03a	0.068a	64.84a
soil + sponge stone (4:1)	64.12a	0.050b	47.87b
F-test	**	**	**
CV.(%)	10.04	14.37	17.04

Values followed by the same letters in a column are not significant at 1% ($p>0.01$) levels, DMRT.

** Significantly different at $p>0.01$.

Table 5 Total N, available P and exchangeable K in soil 56 at DAT.

Treatments	Total N (%)	Available P (mg/kg)	Exchangeable K (mg/kg)
soil (control)	0.26 b	11.31 d	14.53 d
soil + chemical fertilizer	0.41 a	47.94 c	34.50 c
soil + sponge stone (2:1)	0.46 a	89.81 a	85.30 a
soil + sponge stone (4:1)	0.42 a	71.67 b	55.18 b
F-test	**	**	**
CV.(%)	10.61	11.91	11.42

Values followed by the same letter in a column are not significant at 1% ($p>0.01$) levels, DMRT.

** Significantly different at $p>0.01$.



Conclusion

The sponge stone combine with soil 1:2 enhanced the plant growth and quality flower in marigold. Then, sponge stone can be used for growing media in marigold plantation.





Acknowledgment



B S G G L A S S

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