Agro-ecology Workshop

Siem Reap

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Bio Inputs

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Outline

1. Natural Stimulant

Khmer Effective Microorganisms
(KEM)

2. Natural Fertilizers

- Compost

- Green Manure

NATURAL STIMULANT

Khmer Effective Microorganisms

(KEM)

Khmer Beneficial Microorganisms

What are KEM ?

- **KEM are not Fertilizers**
- **KEM are natural stimulant**
- **KEM are made by**

  Khmer raw materials:

  - **Sugar palm**
  - **Water (safe)**
  - ***Morinda citrifolia*** *L. Fruit*
  - ***Indigenous Microorganisms***

How to prepare KEM ?

- **1 part *of Sugar palm***
- **3 parts *of Morinda citrifolia* fruit**
- **10 parts *of Water*** (safe water: non polluted, non chlorated)

  + natural Microorganisms

  from non polluted air, non polluted fruit

KEM benefit from *beneficial effects of*

- ***Morinda citrifolia*** fruit
- **Beneficial Microorganisms**: more than 80 species living with synergy, gathered in 3 groups:
    1. ***Yeast***
    2. ***Lactic Acid Bacteria (Lactobacillus)***
    3. ***Photosynthetic Bacteria***

Fields of KEM Utilization

1. Activation of compost making

2. Rice crop

3. Vegetables

4. Mushroom

5. Poultry, Pig raising

6. Fish raising

7. Cow Scarlet Fever

Activation of Compost making by KEM (Tuk Vil Station)

1. Objective of the trial: ***to improve the quality of Compost and the yield*** of composting , ***to speed up the composting process ;***

2. Methodology: compare 3 piles of compost

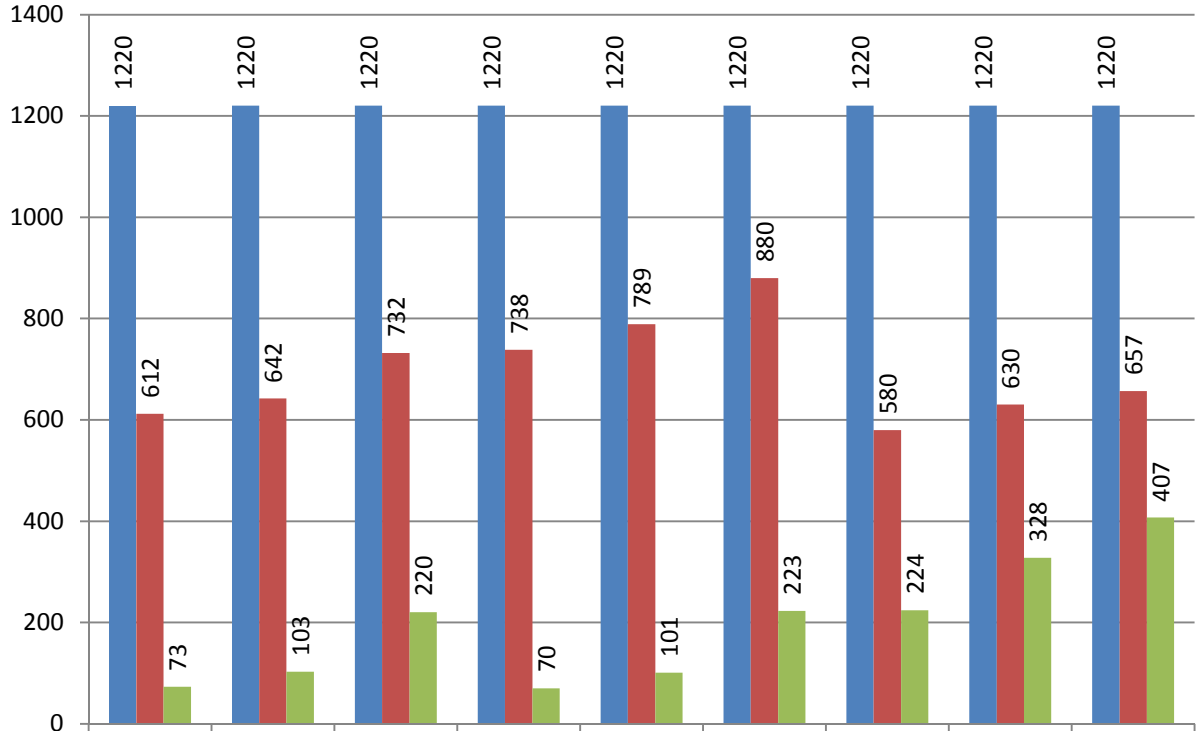
1. ***Control*** : **without KEM** (watering)
2. ***KEM at 5% rate***
3. ***KEM at 10% rate***

3. Results : Pile 10% KEM > Pile 5% KEM> Control

4. Recommendation

Compost activation by KEM

Experiences 1, 2 and 3

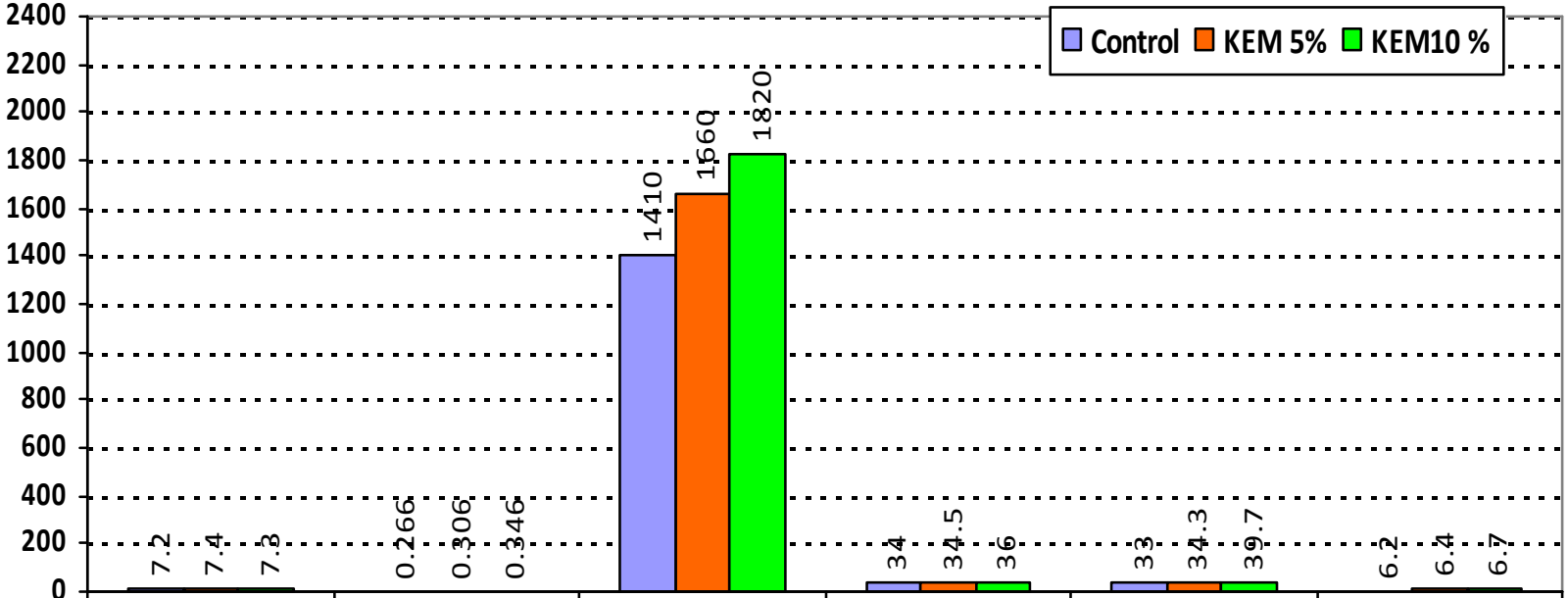


	Control	KEM 5%	KM 10%	Control	KEM 5%	KM 10%	Control	KEM 5%	KM 10%
Compost pile Weight at the beginning (Kg)	1220	1220	1220	1220	1220	1220	1220	1220	1220
Compost pile weight processing at the end (Kg) Sieve 1cm	612	642	732	738	789	880	580	630	657
Fine particles obtained (Kg)	73	103	220	70	101	223	224	328	407

Compost activation by KEM:

improvement of physico-chemical properties

Experience 1

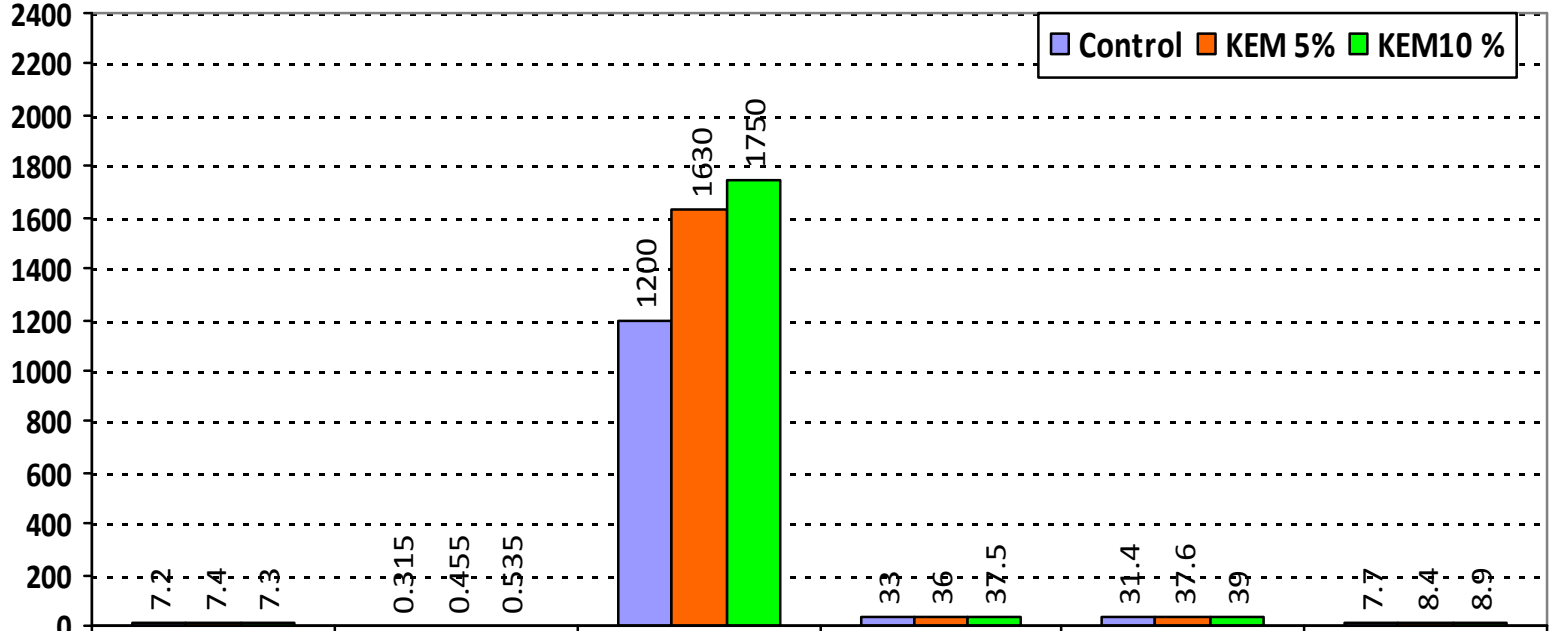


	pH	N%	P available (ppm)	CEC(meq/100g)	SBE (meq/100g)	OM (%)
Control	7.2	0.266	1410	34	33	6.2
KEM 5%	7.4	0.306	1660	34.5	34.3	6.4
KEM10 %	7.3	0.346	1820	36	39.7	6.7

Compost activation by KEM

improvement of physico-chemical properties

Experience 2

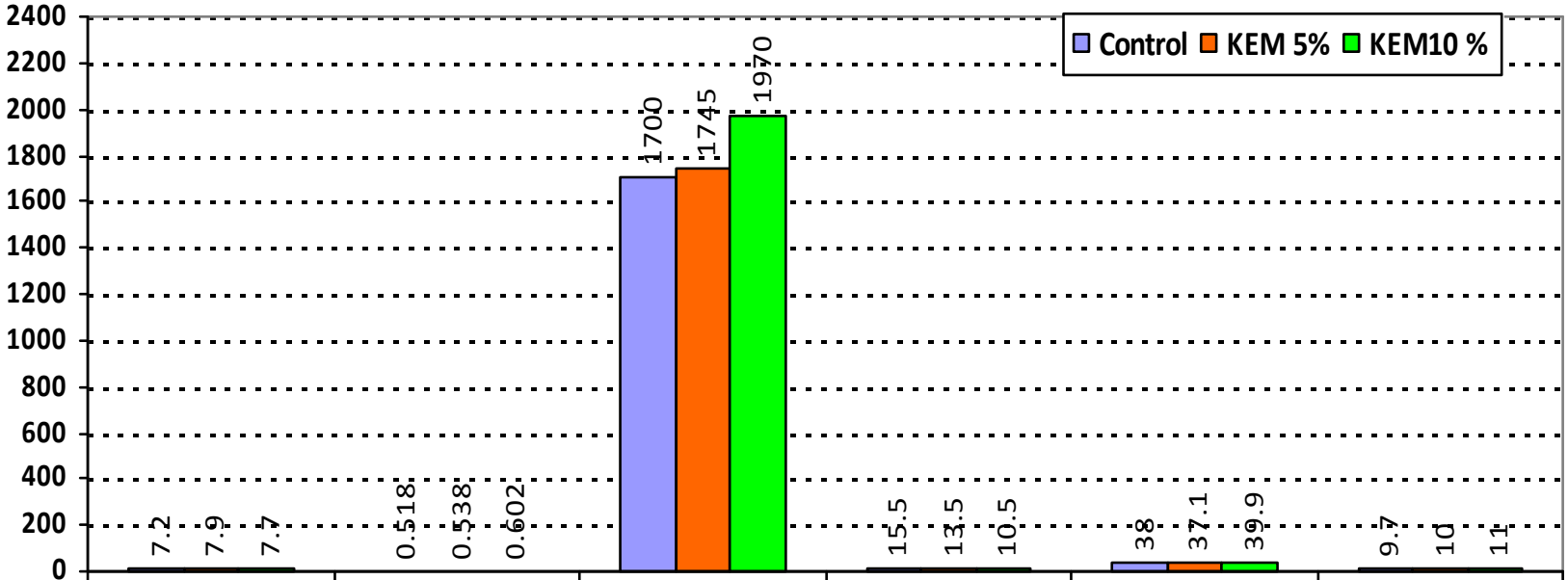


	pH	N%	P available (ppm)	CEC(meq/100g)	SBE (meq/100g)	OM (%)
Control	7.2	0.315	1200	33	31.4	7.7
KEM 5%	7.4	0.455	1630	36	37.6	8.4
KEM10 %	7.3	0.535	1750	37.5	39	8.9

Compost activation by KEM

improvement of physico-chemical properties

Experience 3



	pH	N%	P available (ppm)	CEC(meq/100g)	SBE (meq/100g)	OM (%)
Control	7.2	0.518	1700	15.5	38	9.7
KEM 5%	7.9	0.538	1745	13.5	37.1	10
KEM10 %	7.7	0.602	1970	10.5	39.9	11

KEM in Rice crop

(Tuk Vil Station)

1. Objective of experimentation : to *compare the efficiency of* *Natural Fertilizers* *with* *Chemical Fertilizers* *on Rice Crop (Sen Pidor)*

2. Methodology: RCBD with 5 treatments

T1: Compost 20T/ha
T2: Compost 10T/ha + Bokashi 10T/ha
T3: Compost 5T/ha + Bokashi 5T/ha
T4: Compost 10T/ha + KEM 150L/ha
T5: DAP 60Kg/ha + Urea 100Kg/ha (N2P1)

3. Results: T4 = T5

T4>T1; T4 > T2 >T3

4. Recommendation

KEM in vegetable crop

Bitter Gourd case study (at Chamcar Daung University)

1. **Objective** of experimentation: ***to compare the efficiency of KEM + Cow dung with other organic fertilizers***
1. **Methodology**: RCBD with 4treatments
   - T1: **Cow Dung 15T/ha**
   - T2: **Compost Scaro 15T/ha**
   - T3: **Cow dung 3T/ha** + **KEM 100L/ha**
   - T4: **Bokashi 6T/ha**

3. Results: **T3 > T2 > T1 > T4**

4. Recommendation

KEM in Mushroom production

(experimentation made by National Agriculture School Kg Cham)

1. **Objective**: ***to compare the efficiency of KEM*** *used in medium with* ***other inputs***
2. **Methodology**: RCBD, 4 treatments

T1: **classical medium** (100kg) + **Urea** (0.5kg)
T2: " + **KEM** (1.0 L)
T3: " + ***Sesbania*** (4Kg)
T4: " + ***Leucocephala*** (4Kg)

3. **Results**: **T2 >> T1 >> T3 = T4**
4. **Recommendation**

KEM in traditional raising of Chicken

- **In Cambodia, chickens suffer the stress induced by climate change along the year resulting in high rate of mortality.**
- ***KEM treatment allows to reduce the mortality rate without vaccine use***
- ***KEM treatment favors fast growing***

KEM Efficiency in Traditional Raising of Chicken

		TOTAL Chicken	DEAD Number	DEAD %
DRY SEASON 2007				
	TREATED KEM	3298	89	2.6
	NON TREATED	1656	737	44
RAINY SEASON 2007				
	TREATED KEM	2841	121	4.2
	NON TREATED	1095	298	27.2
KEM RATE 2 ml diluted in 1 L water	Recommended 2 ml KEM for 10 Chicken/Day			

KEM Efficiency in Fish Raising

(***Pangassius Hypophthalmus*** *case study)*

1. **Objective of experimentation**: ***to compare KEM*** *with* ***other inputs.***
2. **Studied Factors**: ***Fodder, water transparency, O2, NH3, pH Phytoplankton, Zooplankton***
3. **Treatments:**

   T0: Control

   T1: KEM (10L in 10 m3 water/week)

   T2: KEM + Cow Dung

   T3: Cow Dung

3. Results: **T2> T1 > T3 >T0**

How to cure Cow Scarlet Fever ?

(fièvre aphteuse bovine)

Provide 4 L of KEM (4% in water) 3 times/day

Result

-After 3 days of treatment, the animal is cured

Note: ***The other cows in the same barn have to be submitted to the same treatment.***

NATURAL FERTILIZERS

1. *Compost*
2. *Green Manure*

COMPOST

1. How to eliminate plant disease and weed seed ?

by Compacting each layer *(5 layers)*

2. What are the appropriate size of compost pile?

1.5m x 2m x 1,5m

3. Balance of different raw materials:

dry waste 1.2T, Chicken(Cow)dung 0.2T, Lime 5Kg;

4. Maintain appropriate humidity

5. How to improve yield & quality of composting ? KEM

6. How to speed up the compost processing ?

Grind the raw material, ***Activate by KEM***

Utilization of Bad compost : *weed seeds have not been eliminated; weed grows as huge as lettuce*

GREEN MANURE in Rice Crop

(Tuk Vil Station)

First Results

1. Cassia siamensis (20T/ha in 3 applications)

Control: **1.7T/ha**

Cassia siamensis: **2.3T/ha (35% better)**

2. Chromoleana sp. (15T/ha)

Control: **1.8T/ha**

Chromoleana: **2.2T/ha (20% better)**

Follow up of Lettuce and Green Cabbage grown in 8 plots (8 treatments), at Tuk Vil Organic Farm

(January 2013 to October 2014)

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Objective

- **We would like to replace chemical fertilizer by organic fertilizer.**
- **We use Compost as main organic fertilizer combined or not with the natural stimulant, KEM and Green manure (*Chromoleana odorata).* Chemical fertilizer(15.15.15.) are used alone(T5) or with Compost and KEM(T3 and T6).**
- **The Control T0 consists of natural soil, without any input.**

Methodology

- **In classical experimentation, to carry out the RCBD in the field is proven delicate due to soil heterogenity.**
- **The soil of the block (with different treatments) has to be homogene. Well, even on small plots, the soil changes rapidly.**
- ***To determine the effect of the treatments, we prefer to follow the same treatments during several crop cycles** and hope to find at the end, its trend along the different seasons of 2-3 years.*

Long term multipurpose trial

(Tuk Vil station on 2 crops)

Treatments	Compost	15.15.15	KEM	*Chromoleana*
T1	0	0	0	0
T2	2kg/m2	0	0	0
T3	2kg/m2	10g/m2	3 watering/week	0
T4	2kg/m2	0	3 watering/week	0
T5	0	40g/m2	0	0
T6	2kg/m2	20g/m2	3 watering/week	0
T7	2kg/m2	0	3 watering/week	1kg/m2
T8	2kg/m2	0	3 watering/week	2kg/m2

Results

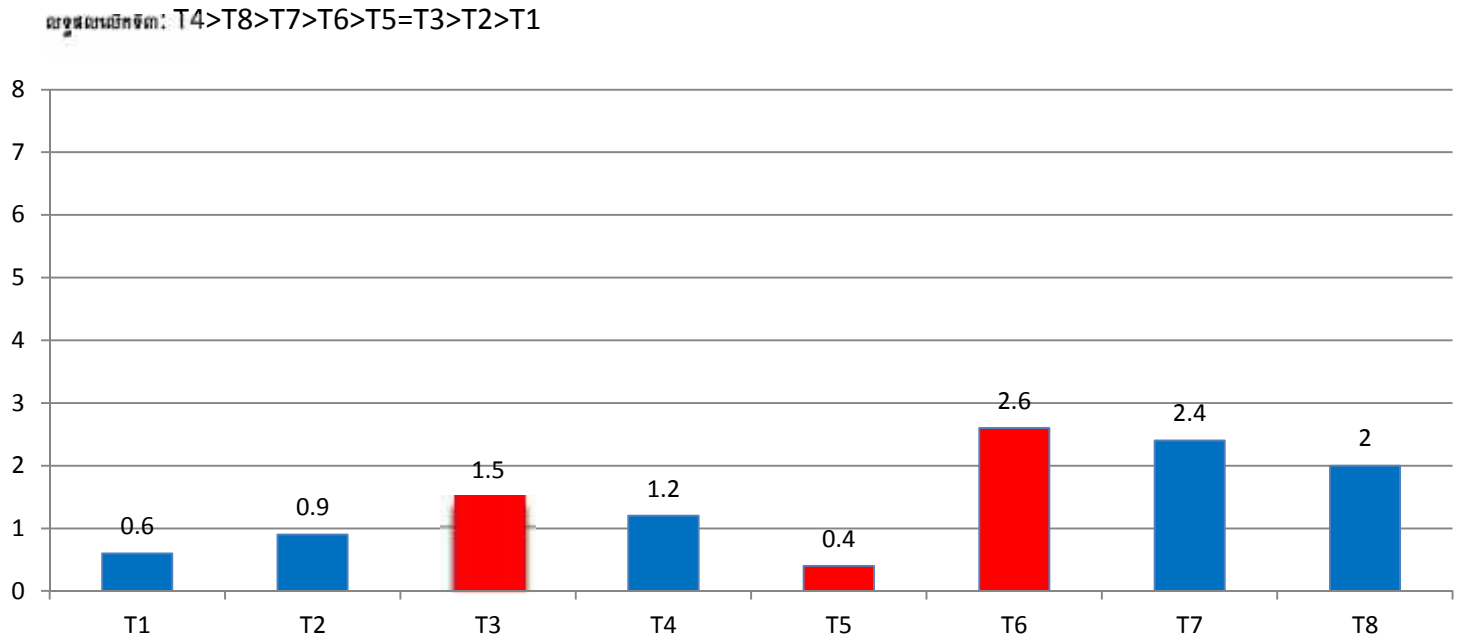
Plots (2m2): **Weight of Crops**(Kg) in **2013**

	T1 Control	T2 Compost 2Kg/m²	T3 Compost 2Kg/m² 15.15.15 10g/m² KEM	T4 Compost 2Kg/m² KEM	T5 15.15.15 40g/m²	T6 Compost 2Kg/m² 15.15.15 20g/m² KEM	T7 Compost 2Kg/m² Chromoleana 1Kg/m² KEM	T8 Compost 2Kg/m² Chromoleana 2Kg/m² KEM	HARVEST date
Lettuce	0.9	1.5	3.2	3.2	3.0	3.6	3.6	3.8	16/01/13
Green Cabbage	1.0	2.5	4.0	4.2	4.0	4.3	4.5	4.7	23/02/13
Lettuce	0.9	1.6	3.5	3.3	2.9	3.7	3.5	3.6	02/04/13
Lettuce	0.3	0.5	0.9	0.9	0.6	1.2	0.8	1.0	05/06/13
Green Cabbage	0.1	1.2	1.4	1.6	0.4	1.6	1.6	1.2	20/09/13
Lettuce	0.7	1.0	1.8	1.5	1.0	2.7	2.1	1.8	29/10/13

Results

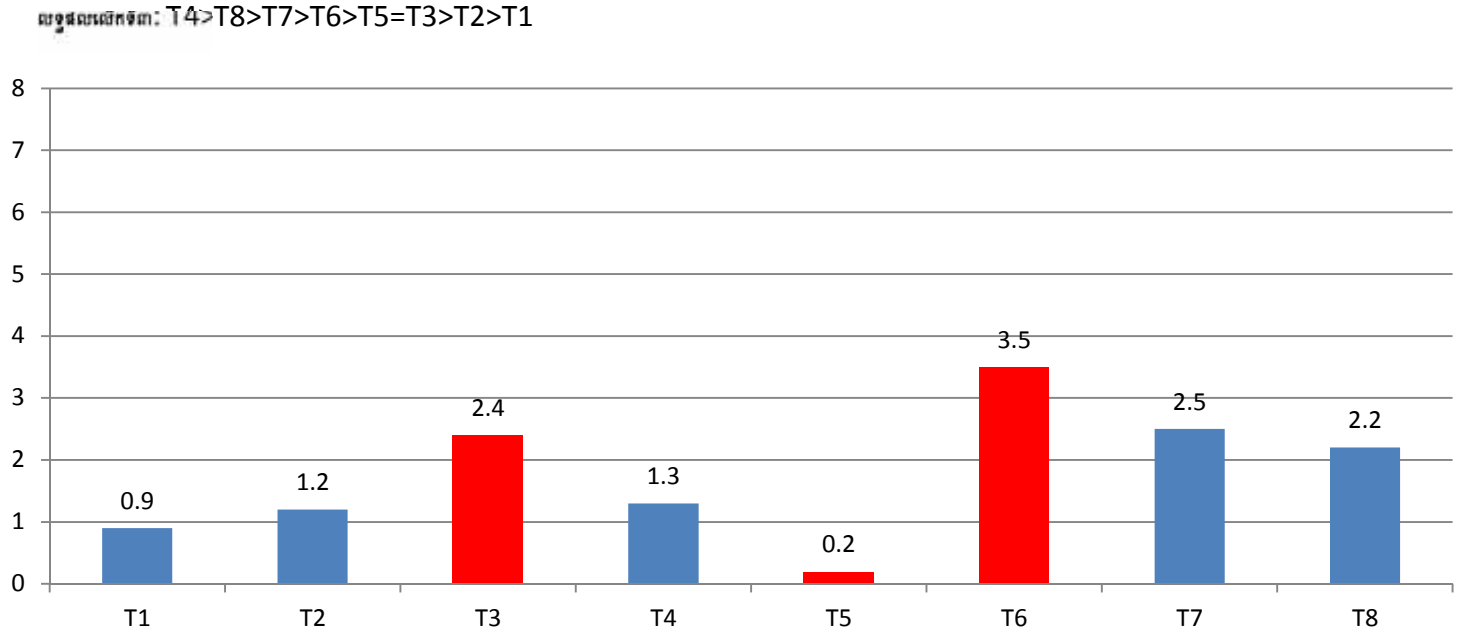
Plot (2m2): Weight of Crops(Kg) in 2014

	T1 Control	T2 Compost 2Kg/m²	T3 Compost 2Kg/m² 15.15.15 10g/m² KEM	T4 Compost 2Kg/m² KEM	T5 15.15.15 10g/m²	T6 Compost 2Kg/m² 15.15.15 20g/m² KEM	T7 Compost 2Kg/m² Chromoleana 1Kg/m² KEM	T8 Compost 2Kg/m² Chromoleana 2Kg/m² KEM	HARVEST date
Green Cabbage	0.8	1.8	3.5	3.5	3.0	7.5	5.0	6.0	13/01/14
Lettuce	0.9	1.8	4.8	4.6	3.6	4.9	5.8	6.0	03/03/14
Green Cabbage	0.2	0.5	0.6	0.5	0.5	0.7	0.8	0.9	17/04/14
Lettuce	0.6	0.9	1.5	1.2	0.4	2.6	2.4	2.0	10/08/14
Green Cabbage	0.9	1.2	2.4	1.3	0.2	3.5	2.5	2.2	09/10/14



LETTUCE

Harvest:09/10/14



Green Cabbage

Harvest:09/10/14

Comments

- **T1: Control,** *without any input. It naturally gives le lowest harvest*
- **Comparison T3 (Compost + 15.15.15. 10g + KEM) and T4 (Compost + KEM)** : *on the whole,* ***the results are similar,*** *so no need to use 15.15.15*.
- **Comparison T3 (Compost + 15.15.15. 10g + KEM) or T4 (Compost + KEM) and T5 (15.15.15. 10g)**

T3 > T5

T4 > T5

The chemical fertilizer used alone gives the lowest yield

Comparison T3 (Compost + 15.15.15. 10g + KEM) and T6 (Compost + 15.15.15. 20g + KEM)

Except in January, ***the yield is not doubled with 15.15.15 at a rate 2 times higher(20g/m2),*** so 10g is enough**.**

- **Comparison T7 (Compost + *Chromoleana 1Kg/m2* + KEM) and T8 (Compost + *Chromoleana 2 Kg/m2* + KEM)**

The yield is not doubled with Chromoleana at a rate 2 times higher, on the whole, we got similar production.

So, 1 Kg/m2 of ***Chromoleana*** *is enough***.**

- **Comparison T3 (Compost + 15.15.15. 10g + KEM) and T7 (Compost + *Chromoleana 1Kg/m2* + KEM)**

T7 gave better yield in majority of cases. *The use of* ***Chromoleana*** *is preferable to chemical.*

Recommendations

- **First choice:** **T4 (Compost + KEM) or T7 (Compost + *Chromoleana 1Kg/m2* + KEM)**
- **Second choice: T3 (Compost + 15.15.15. 10g + KEM)**

It is necessary to follow up the results obtained by the farmers and to record all data dealing with the crop growth conditions.

Thanks

for your kind attention