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RESEARCH ARTICLE

EFFECT OF COMBINED-FERTILIZERS OF CATTLES' MANURE AND UREA ON VARIOUS PARAMETERS OF DIFFERENT GRASSES

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ABSTRACT

Fertilization becomes an important factor in plant production management. The availability of pastures in cattle's industry, therefore, becomes a prerequisite step. Current research was then aimed to know the effect of combined-fertilizers between cattle's manure and urea to the growth of three species of grasses which commonly cultivated for grassing, including their best combination as part of a good management practices on crop production. In order to answer the question, a split plot design was applied to observe the effect of combined-fertilizers between cattle's manure and urea toward plant's height and mass production along the three grassing periods. The main plot was three species of grasses as follows: *Setaria anceps*, Nevalensis, and *Brachiaria Hybrid cv "Mulato"*, while the sub-plot is combined-fertilizers of cattles' manure at concentrations of 10 and 20 tons per hectare per grassing period and urea at concentrations of 100, 150 and 200kg per hectare per grassing period. Each treatment was performed in triplicates, to end up a total of 54 treatment plots. The observed variables were plant's height, fresh and dry masses, these data were obtained from three grassing periods and analysed statistically. The currfent study indicated the genetic factors of the grasses were taking more significant role than treated-combined fertilizers. Here, different types of grasses showed significant different among them, in all observed parameters, while the combined-fertilizers showed a linear graph in all variables. The best dosage of combined-fertilizers, however, was reached by combination of 20 tons cattles' manure and 200 kgs urea per hectare per grassing period.

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INTRODUCTION

Basically, plants grow well when the required nutrients are available in adequate amount in the soil either naturally or artificially. Apart from that Salendu *et al.* (2012) suggested sunlight is also important in triggering photosynthesis processes. In most of the cases, studies about application of fertilizers on plants' growth are related with their dosages, combination and sources either natural or artificial. According to Min *et al.* (2012) application of natural fertilizer maintains soil quality but not the artificial fertilizers ones. Mahdi *et al.* (2010) suggested application of natural fertilizers like cattles manure which gives some benefits to the soil by repairing its structure (Novo *et al.,* 2016). Meanwhile urea is the most commonly applied artifical fertilizer. In many countries and regions,dairy cattle husbandries have been being developed to fullfil people's animal livestock demand (Lundqvist *et al.,* 2007) leads to manures production in an abundant amount which might be used as natural fertilizer. But, this potential has not been being applied optimally. Hendarto *et al.* (2015) stated, both natural and artificial fertilizers have closed-texture and the fore might be applied simultaneously as combindd-fertilizers to give some benefits like: efficiency of growing media and optimum plant's growth. Furthermore, Khan *et al.* (2009) stated the combined-fertilizers keepsthe soil's health to allow optimum plants' growth, including grasses, ruminantia feed stocks. Current study was aimed to obtain proper concentration of combined–fertilizers between cattles manure and urea toward three different species of grasses namely Mulato (Brachiaria Hybrid cv "Mulato"), Nevalensis and Setaria (Setaria anceps). Hendarto and Suwarno (2017) stated grasses growth rate can be observed from various parameters such as height, and forage productions (fresh and dry mass). Application of combined-fertilizers becomes a prerequisite in grasses production as well as maintaining soil quality and further might also be applied to other crops.

MATERIALS AND METHODS

An experimental research with a Split Plot Design was done previously by applying combined-fertilizers to three different species of grasses for their growth, forage and dry mass

production. The main plot was grasses type (Mulato (Brachiaria Hybrid cv "Mulato"), Nevalensis, and Setaria (Setaria anceps)) while the research's sub plots were dosages of combined-fertilization10 and 20 tons cattles manure and 100, 150 and 200 kgs urea per Hectare. These combinations were applied to the soil one time per grassing period and performed in triplicates to end up a total of 18 treatment combinations. The Indonesian farmers, however, applied a concentration of, 9.2 grams Nitrogen per meter square ≈ 920 Kg per Hectare to their paddyrice field. The parameters observed were plant's height, fresh forages and dry masses. Current study involving a serial activities started from land clearing, fertilizing the soil, planting, observaing plant's growth, grassing and examining dry matter content and running data analyses. The area was divided into 18 plots each of 3 meter square, making up a total of 54 research plots with interval of each plot is 1 meter. An initial study was done in different area by applying a particular dosage of combined-fertilizer which was spreaded to the soil and stated as predetermined dosages. The dried cattles manure was mixed up evenly with urea and set as the planned concentrations, each concentration of combined-fertilizers was spreaded to the soil of research plots. The grasses were planted in the research plots with each of 12 grass-groves with interval of 25 x 75 cm each. Observation was taken at 60-days after planting (DAP) for their plant's height, then grassed. The grassed-foliars were recorded for their fresh weight masses produced. 100 grams of them were taken randomly and dried in an oven which set up at 105oC for 24 hours to the constant weight and calculated for their dry weight. Combined fertilizers at the same dosages were applied for second time on next consecutive 7th days after previous grassing. The second and third grassing activities were done at the shorter age (40 days) and observed for the same parameters. Data were analyzed statistically for their mean data of plant's height, fresh and dry masses weight following three grassing processes. The plant's height was measured prior to grasing by measuring the leaf's height of each plant, the data of fresh product were obtained from fresh weight of total biomass of each plot, and the dry weight was taken from dried-grasses following drying process. The data were then analyzed for their variance, and followed by orthogonal and regression when significant differences between treatments were appeared.

RESULTS AND DISCUSSION

Research's site Condition: Current study was conducted on former paddy rice field, with charateristics of dusty clayand pH of 5.53. The soil contains 0.009% Nitrogen, $P_2O_5$of 0.932 ppm and K2O at 0.593 % (Soil Laboratory, Agriculture Faculty of Unsoed). According to Lundqvist *et al.* (2007) the research site belongs to the land with low decomposition rate, and support the plants to grow optimally in such environemental condition. The combined-fertilizersindicates nitrogen content of 0.3000 – 0.390%, 0.231 – 0.256% P_2O_5, and 0.351 – 0.654% K_2O the combined-fertilizers in this study might then perform better than singly (Chen *et al.*, 2003). Table 1 showed the research site is fairly support the grasses' growth, and is expected to reach their optimum growth in term. The higher adaptibility of the grasses to the research site, the more forage will be produced leads to a support to the ruminant farming industry directly; sustainhuman existence and prosperity (Ferreira *et al.*, 2015). Georgiadis (2007) put forages as the main feed for ruminants and suggested its availability in the farm prior to the arrival of animals.

Table 1.Nutrient content of combined-fertilizers between cattles manure and urea (*)

No	Treatments/Ha/grassing	Nutrient content		
		K	N	P
1	100 kgs urea + 10 tons manure	0.35	0.30	0.23
2	150 kgs urea + 10 tons manure	0.40	0.30	0.23
3	200 kgs urea + 10 tons manure	0.42	0.39	0.23
4	100 kgs urea + 20 tons manure	0.51	0.33	0.23
5	150 kgs urea + 20 tons manure	0.63	0.33	0.26
6	200 kgs urea + 20 tons manure	0.65	0.39	0.25

(*)Soil Science Laboratory, Faculty of Agriculture, Jenderal Soedirman University (2014)

Plant's Height

Current study noted the mean of Nevalensis grass height was 119.75 cm, followed by Setaria and Mulato (62.35 cm and 58.67 cm respectively), indicating the genetic characters play significant role in forage production. Nevalensis grasses are known to performed better than the rest two species. Table 2 confirmed if cattles manure take longer timer to decompose and time time to be aailable in the soil to be adsorbed by the grasses than urea.In this situation, Jan *et al.* (2014) stated the grasses do not longer need soil nutrients in large amount as the plants have reached their generative phase. Hendarto (2005) suggestedcombined-fertilizers of manure and urea as an alternative way on good management practices providing feed plants.

Table 3. Mean value of plant's height at the applied Combined-Fertilizer concentrations

Table 2. Influence of Combined Fertilizer on Grass's Mean Plant Height

No	Treatments/Ha/ grassing	Grass's Mean Plant Height (cm)		
		Setaria anceps	Nevalensis	*Brachiaria hybrid cv "Mulato"*
1	100 kgs urea + 10 tons manure	57.53	109.80	53.07
2	150 kgs urea + 10 tons manure	57.13	116.47	53.57
3	200 kgs urea + 10 tons manure	61.30	123.03	60.00
4	100 kgs urea + 20 tons manure	57.70	119.40	60.90
5	150 kgs urea + 20 tons manure	65.43	126.37	56.56
6	200 kgs urea + 20 tons manure	75.00	123.43	67.90
	Mean	62.35	119.75	58.67
	Total Mean	80.26		

Table 3 shows urea fertilizer of 200 Kg per hectare per grassing, increased plant's height and agreed to the results of Huang *et al.* (2004) who reported that of fertilizers contain nitrogen such as manures and urea accelerated the plant's growth. Similarly, application of cattles manure 20 tons per hectare also increased the plant's height.

The ANOVA indicated the grass species and the combined fertilizers had a highly significant influence ($P < 0.01$) on plant's height but not to their interaction ($P > 0.05$). Among those species Nevalensis plant's showed significat growth different ($P < 0.01$) to the rest species Setaria and Molato. Meanwhile, the Setaria did not show significant different to Molato ($P > 0.05$)indicated differences in their genetic factor. The regression analyses showed a linear equation ($P < 0.01$) of combined-fertilizers between manuresand urea $Y = 0.6756 X + 70.122$. Similarly, on the application of urea singly, which also showed a linear equation ($P < 0.01$) with$Y = 0.0871 X + 67.189$. Both match to Chen, et al's (2003) fertilization influenceplant's growthsignificantly. Yet, these equations did not reach the optimal dosage of both fertilizers.

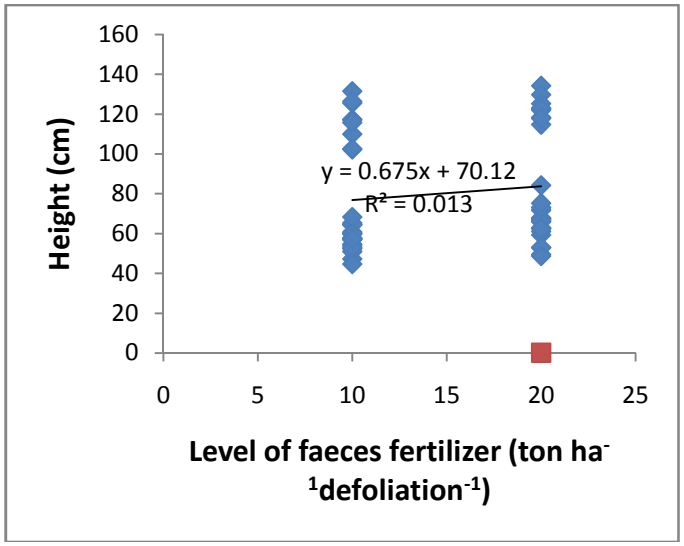

Figure 1. Correlation between dosages of cattle's manure and mean value of plant's height

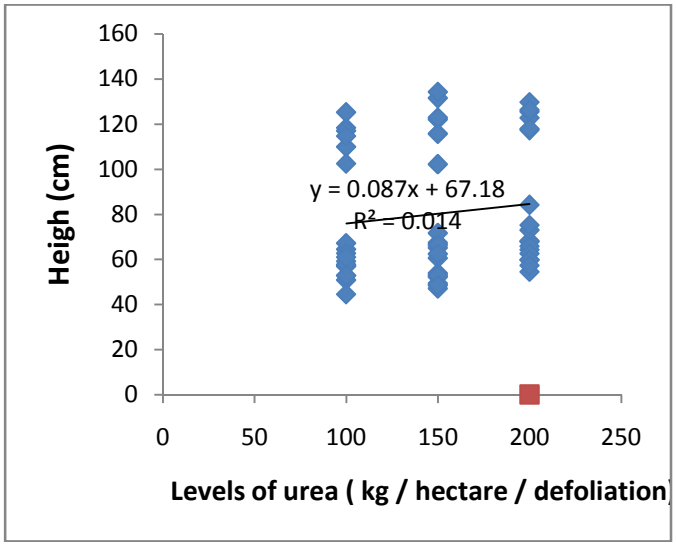

Figure 2. Correlation between dosages of urea and mean value of plant's height

Fresh Forage Production

Mean total production ofgrasses was 5.677,78 gramsforageper plot (3 m^2)≈1.892,6 grams per m^2or equal to 18.926 kgs per hectare per grassing period or 170.333 kg per hectare per year for 9 grassing p.a.; indicated the high production rate of medium texture grass (Jank *et al.,* 2007). The highest mean of production rate due to application of combined-fertilizers showed by the three species of grasses were (6.316,67; 5.605,56 and 5.111,11 grams/3 m^2) fpr Setaria, Mulato, and Nevalensis. Indicating the first specieswas responded well to the combined-fertilizers as seen on their morphological characters. Jank *et al.* (2007) stated the Setaria grasses have multiple andspread-rootsstructure on its cluster, leads to a better absorbtion of nutrient in the soil. Hendarto *et al.* (2015) reported application of combined-fertilizers of cattles manure atthe concentration of 20 tons and 150 kgs urea per Ha/grassing showed the best result on their height and so production of Mulato. Moreover, Xiangyang *et al.* (2011), suggested fairly high dose manure to to increase plant's growth and production, including forage. Tudsri *et al.* (2002) added combined-fertilizers is possibly to be applied to all plants. Current study showed an ANOVA analysis within the grasses species, which was significantly different($P < 0.05$), indicating the Setaria produced the highest fresh forage production. The combined-fertilizer treatments indicated alsoa varied number of fresh forage production among all combinations (Table 4). This finding confirmed the research conducted by Hendarto *et al.* (2015), the higher the dose the fresher productcan be obtained. Tomar *et al.* (2003) stated nitrogen contained in fertilizer contributed greatly to the grass growth and productivity.

Table 3. Mean vlue of Combined Fertilizer on production of Fresh Forage

No	Treatments (ha/grassing)	Mean Fresh Forage Production (grams/3 m2)		
		Brachiaria Hybrid cv "Mulato"	Nevalensis grass	*Setaria anceps*
1	100 kgs urea + 10 tons manure	3,300.00	3,400.00	4,866.67
2	150 kgs urea + 10 tons manure	4,766.67	4,866.67	4,933.33
3	200 kgs urea + 10 tons manure	5,666.67	5,466.67	7,000.00
4	100 kgs urea + 20 tons manure	6,066.67	5,600.00	6,866.67
5	150 kgs urea + 20 tons manure	6,333.33	5,666.67	6,900.00
6	200 kgs urea + 20 tons manure	7,500.00	5,666.67	7,333.33
	Mean	5,605.56	5,111.11	6,316.67
	Total Mean	5,677.78		

Current study noted the highest forage production obtained fro, the highest concentration of combined fertilizers($P < 0.01$). Similarly when fertilizer was applied singly either cattles manure or urea as well as their interaction. The dosages of cattles manure produced a linear equation ($P < 0.01$) $Y = 173.31 X + 2.970.8$ (Fig 3) and similarly the urea which was also showed a linear equation ($P < 0.01$) $Y = 11,003 X + 3,920$ (Fig 4). These data confirmed Kariuki *et al.* (2016) that the high nitrogen availability on the soil is important in the production of food crops;and Chen *et al.* (2003) nitrogen can be applied both separately and jointly with organic fertilizers.

Table 4. The mean fresh forage production influenced by Combined-Fertilizer

No	Urea (ha/ grassing)	Mean Fresh Forage Production (grams/ 3 m2)		Mean (grams)
		10 tons manure	20 tons manure	
1	100 kgs	3,855	6,178	5,016
2	150 kgs	4,855	6,300	5,577
3	200 kgs	6,044	6,833	6,438
	Mean (grams)	4,918	6,448	5,677

Xiangyang *et al.* (2011) statedan adequate amount of nutrients added to the soil leads to a positive effect on the plant's growth. Current data were relevant to Nyambati *et al.*(2011) and Sanderson *et al.* (2007) addition of manure repairs the soil structure and textureto support the plants perform well.

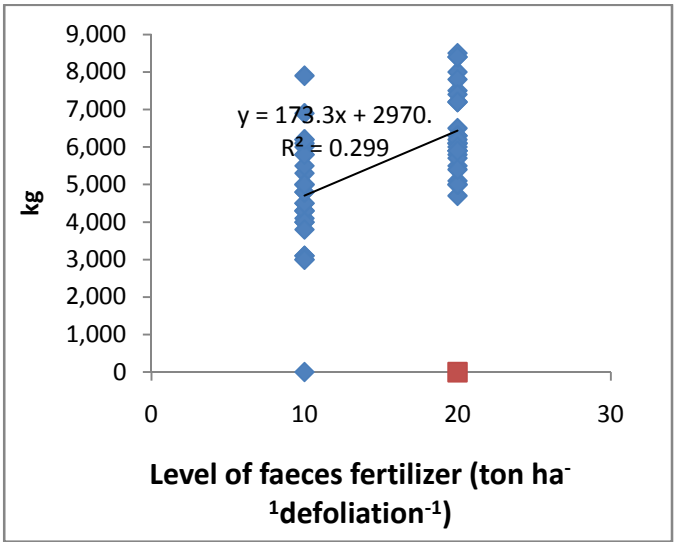

Figure 3. Correlation between dairy cattle's manure and mean value of fresh forage production

Fig. 2 confirmed Hendarto *et al.* (2015) application of combined-fertilizers of cattles manure and urea of up to 150 kgs per ha per grassing had not reach the optimum growth. Likewise, Hendarto (2005) urea at the doses of up to 225 kgs per ha per grassing and combined-fertilizers with chickens manure had not reach their optimal dosages. It is then possible to conduct further researches by adding the fertilizer concentrations to a higher level.

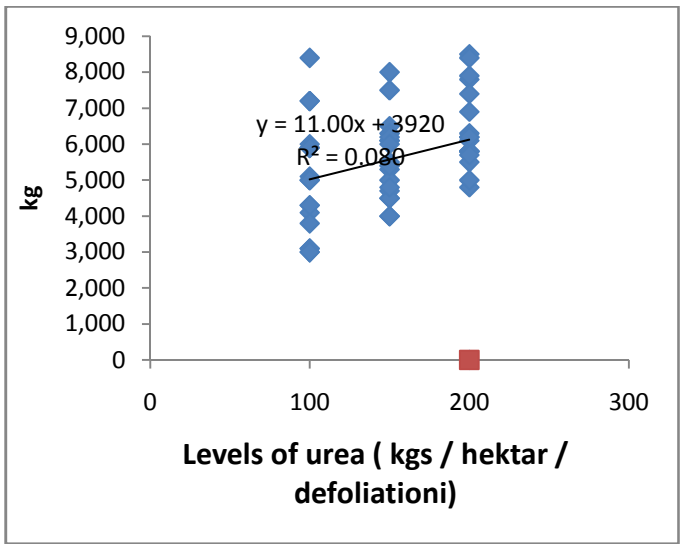

Figure 4. Correlation between concentration of urea and mean value of fresh forage production.

The combined-fertilizers contain adequate anount of nitrogen compound, and its presence in the soil leads to optimum plant's growth (Hendarto and Suwarno, 2017). The nitrogent compound in urea fertilizer when it is mixed with cattles manure, incrasesits absorbility by the plants (Kariuki *et al.*, 2016). Tomar *et al.* (2003) stated, the plantsutilize the nutrient from ureahwhen they need a particular nutrient. However, this application might not be adopted immediately. On the oher hand, organic fertilizer, needs to be decomposed into simpler compounds prior be adsorbed by the plants. During this decomposition processes, the plants utilize nutients from in-organic fertilizer, and starts utilizing simpler compounds of organic fertilizers when when they reach generative growth phase due to its long period to decomposed it fully (Novo *et. al.*, 2016). Current reseach recommended application of combined-fertilizers of cattles manure at 20 tons per Ha and urea at 200 kg per Ha/grassing; but not in excessive numbers (Mahdi *et al.,* 2010).

Production of Dry Mass

The mean production of dry masses was 1.015,64 gram per plot (3m^2) or 3.385,47 kgs per Ha per grassing which is equal to 30,469.22 kgs per Ha p.a. assuming if it the tearly grassing activities are 9 times. Table 6 shows the highest production of dry masseswas obtained from the Nevalensis (1,066.67 grams/3 m^2, followed by Mulato (1,027.21 grams/3 m^2)and Setaria (953.04 grams/3 m^2). These data were quite different from their fresh forage production, wherethe highest production was from Setaria, followed by Mulato and Nevalens is might due to the dry masses content of each forage. The laboratory analysis showed, the mean of dry masses content of Setaria was 15.09%, grass 20.87 % and Mulato 18.72%; leads to the different sequence of dry masses production, unlike the sequence of fresh forage production. These dry masses content values were consistent to the feed material nutrition quality list (Shen *et al*., 2012). The higher cellulose and hemicellulose compound in feed forage the more rendered to the rument's microbes in degrading the fibres (Bhilave, 2013). Whereas, the high water content in forage the more microbes contamination would be (Okaraonye and Ikewuchi, 2009). Berihu *et al*. (2015) added that the constraining factor of feed crop production in tropical region is on its the nutrition value. We noted, the highest mean production of dry masses was reached from the combination of20 tons cattles manure per Ha/grassing and 200 kgs urea/Ha/grassingi.e.: at 1.221,81 gramsbut lower dosages was generatedin lower production. Table 6 also indicated the increase of urea dosage to low dosage of cattles manure resulted in the lowest dry massthan when the urea was given at low dose but high cattles manure concentation. This is consistent to the condition of its fresh forage production. The result of research by Hendarto *et al.* (2014) in Hendarto *et al.* (2015) also showed a similar condition applied to Setaria (*Setaria anceps*), Benggala and Greenpanic grasses.Chen *et al*.(2003) in Hendarto *et al.* (2015) added the nutrient comppounds of cattle'smanure are readky available to be absorbed by the plant, and the addition of nitrogen compound in urea, therefore.Will be used in an integrated manner as shown by the plant production rate,including the production of dry matter of grasses.

The ANOVA showed dosages and their interactions had a significant effect to the dry matter production ($P < 0.01$). The cattles manure treatment dose indicated a linear equation ($P < 0.01$) $Y = 26{,}499\ X + 609.06$ (Fig. 5/), and also the urea ($P < 0.01$) $Y = 2{,}6323\ X + 611{,}7$ (Fig. 6.). These data indicated the increasement of fertilizer's dosages leads to increase in the dry mass and confirmed Dutra *et al.* (2015), the physiological processes of the plant by utilization of available nutrientsin the soil aided by the sunlight are important for the plant's development, including production of dry masses. The plant's growth and production are significantly influenced by nutrient

availability which might be added by fertilization.Combination between livestocks manure and ureaat certain dosages,resulted in more efficient agricultural practices, especially in soil fertility as well as plant's production (Jigme *et al.*, 2015; Madauna (2009) and Wijitphan *et.al*., 2009b).

Table 5. The mean value of dry masses production influenced by Combined-Fertilizer

No	Treatments (ha /grassing)	Mean Production of Dry Matter (grams/3 m2)		
		Brachiaria Hybrid cv "Mulato"	Nevalensis	*Setaria anceps*
1	100 kgs urea + 10 tons manure	610.33	693.70	731.73
2	150 kgs urea + 10 tons manure	739.97	1,030.90	753.37
3	200 kgs urea + 10 tons manure	1,063.67	1,147.33	1,051.53
4	100 kgs urea + 20 tons manure	1,103.43	1,183.87	1,034.93
5	150 kgs urea + 20 tons manure	1,221.57	1,180.40	1,069.33
6	200 kgs urea + 20 tons faeces	1,424.30	1,163.80	1,077.33
	Mean	1,027.21	1,066.67	953.04
	Total Mean (gram)	1,015.64		

Table 6. The mean value of dry masses production influenced by Fertilizer's Dose

No	Treatment (ha/grassing)	Mean Production of Dry Matter (gr/3 m2)		Mean (gr)
		10 tons manure	20 tons manure	
1	100 kgs urea	678.59[a]	1,107.41	893.00[d]
2	150 kgs urea	841.41[b]	1,157.10	999.25[e]
3	200 kgs urea	1,087.51[c]	1,221.81	1,154.6[f]
	Mean (gram)	869.17[g]	1,162.11[h]	1,015.64

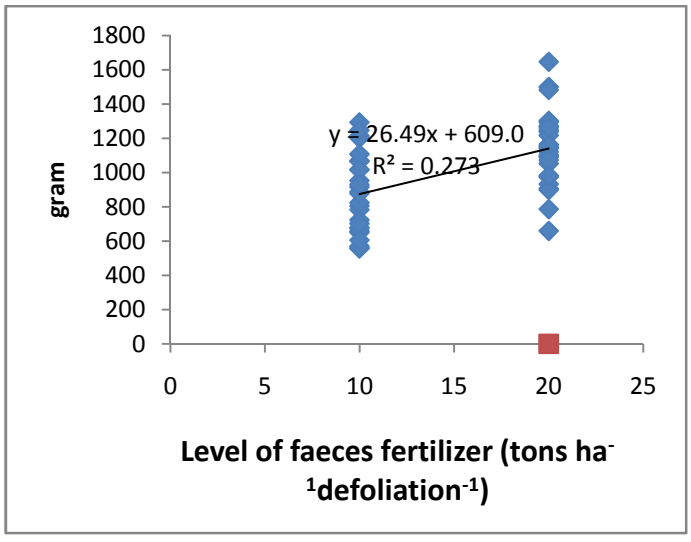

Figure 5. Correlation between dosages of cattle's manure and the mean production of dry masses.

Current study noted interaction of fertilizationresulted in significant different ($P < 0.01$) indicated that a certain dosage of fertilization leads to the best plant's growth. The combined-fertilizers of 20 tons cattles manure and 200 kg urea .Ha/grassing generated the best production of dry massesand worth-recommending. This is consistent to the production of fresh forage, and more worthed if it is applied on the field, and it is even possible to be applied to other plants (Wijitphan *et al.,* 2009b).

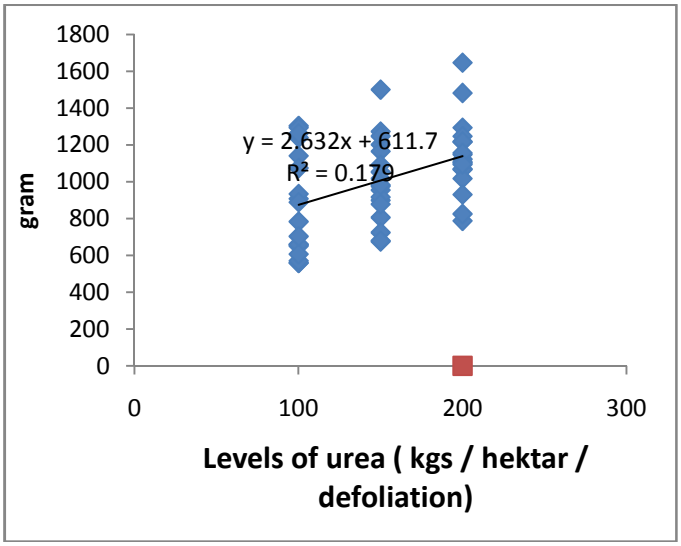

Figure 6. Correlation between dosage of urea and mean production of dry masses.

Conclusion

The current data, might be concluded as follows:

1. Setaria (*Setaria anceps*), Mulato (*Brachiaria Hybrid cv "Mulato"*) and Nevalensis grassesgeneratedplant height,fresh forage production and dry massesin a different rank depend on their genetic performances.
2. The combined-fertilzers between cattle's manure of up to 20 tons and urea of up to 200 kgs per Ha/grassing performed best on plant's height, fresh forage production and dry masses.

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