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The Effects of Lime on Acid Properties of Soil and on Faba Bean Yield in Banja District. The Case of Sankit Lideta, Awi Zone Amhara Regional State, Ethiopia

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Abstracts

This study was conducted in the known acid soil area of Ethiopia Awi zone which is found in the Amhara regional state. Five levels of lime introduced (0, 1150kg/ha, 2300kg/ha, 3450kg/ha, 4600kg/ha) on the faba bean productivity in the acidic soils. This experiment was arranged in a factorial experiment using randomized complete block design (RCBD) with three replications and 39 .13kg/ha Urea and100kg/ha TSP had been used as the source of N and P, respectively. Crop data such as plant height, biomass yield and grain yield , 50% flowering ,50% maturity,95% maturity, number of pods/plant ,number of seeds /pod ,number of seeds /plant ,lodging ,stand count at emerge and harvest collected and analyzed using SAS Software version 9. The result of this study indicated that 4600kg/ha, lime brought significantly higher result than the control. As lime level increased from the 0 to 4600kg/ha, grain yield, 50% flowering, biomass yield, number of pods /plant, number of seeds/plant increased. However, as lime level increased the number of seeds/ pod, stand count at emerges, stand count at harvest, 50%maturity, 95%maturity did not bring significant change.

Keywords: Lime; Soil Acidity; Faba bean yield.

1. Background and justification

Soil acidity is among the major land degradation problem worldwide. It is estimated that over 11 million ha of land is exposed to soil acidity around the world [1]. Tropical and sub-tropical regions as well as areas with moderate climatic conditions are mostly affected in soil acidity. Worldwide, 32% of all arable land is acid and that figure claims to be 50% in tropics.

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In this region, high rainfall and temperature are dominating throughout the year round and results into high rate of weathering of the soil, high rate of leaching nutrients from soils, very rapid destruction of soil physical structure and texture, quick and changes in the soil acidity are the net effect of a series of contemporaneous processes, some responsible for generating acidity in the soil solution, others neutralizing acidity. Soil acidity is an impediment to agricultural production in areas where heavy rainfall is causing nutrient loss by way of leaching and soil erosion. It is a complex process resulting in the formation of an acid soil due to excessive concentration of non-soluble and toxic ions in the soil solution. In the context of agricultural problem soils, acid soils are soils in which acidity dominates the problems related to agricultural land use. Consequently, the level of aluminum and hydrogen becomes too high causing the soil's negatively charged cation exchange capacity to be overwhelmingly blocked with positively charged hydrogen and aluminum, and the nutrients needed for plant growth become unavailable resulting into inhibition of root growth and plant development [2]. Soil acidity does not just consist of H ions in soil solution but is associated with many components of the soil. It is determined by soil composition, ion exchange properties and hydrolysis reactions. Soil components include both inorganic constituents and soil organic matter. Active inorganic constituents involved in soil reaction and acidity are the layer silicate clays and mineral oxides. Silicate clays are the sources of permanent negative charge that is the CEC of the soils. They are composed of one layer of Al-oxide and one or two layers of Si-oxide bonded together by a shared layer of oxygen atoms. The negative charge in the crystal lattice of layer silicate clays arises from the isomorpohous substitution of Al3+ by Mg2+ or Si4+ by Al3+ leaving a deficit of positive charge or a net negative charge in the crystalline structure soil pH, that is, the concentration of H ions in soil solution. Knowing the soil pH helps identify the kinds of chemical reactions that are likely to be taking place in the soil. Generally, the most important reactions from the standpoint of crop production are those dealing with solubility of compounds or materials in soils. In this regard, we are most concerned with the affects of pH on the availability of toxic elements and nutrient elements toxic elements like aluminum and manganese are the major causes for crop failure in acid soils. These elements are a problem in acid soils because they are more soluble at low pH. In other words, more of the solid form of these elements will dissolve in water when the pH is acid. There is always a lot of aluminum present in soils because it is a part of most clay particles. Increased acidity is also likely to lead to poor plant growth and water use efficiency as a result of nutrient deficiencies and imbalance, and or induced aluminum and \manganese toxicity. Aluminum and Mn in the root zone are known to cause a serious problem in plant productivity in sub-humid and humid regions of the world [1]. Aluminum affected roots tend to be shortened and swollen, having a stubby appearance. Also high concentration of Al affects uptake and translocation of nutrients (especially immobilization of phosphorus in the roots), cell division, respiration, nitrogen mobilization and glucose phosphorylation of plants [3].The effects of soil acidity, acidification, and liming can be classified into three main categories that cannot always be sharply distinguished: the availability of nutrients, and toxic elements, and soil structure. The availability of essential plant nutrients is affected by soil pH. In acid soils, there are problems of both plant nutrient deficiencies and toxicities of three elements (Aluminum (Al) Manganese (Mn), and Hydrogen (H+).Plant growth, and especially root growth, in acid soils is retarded by toxicities of Al, Mn, and H+. The degree of toxicity depends upon how high the concentration of soluble or exchangeable Al3+ is and how low the pH is [4]. Generally, soil acidity is a serious problem in Awi zone particularly Banja district Amhara regional state. The main causes of soil acidity in Awi zone Amhara regional state are high rainfall, parent materials, plowing of the land repeatedly, organic decay, great demands of agricultural land due to increasing of population. As a result , today the soil fertility level declines from year to year .Those, basic nutrients such as calcium ,magnesium, phosphorous ,potassium are leaching away and those toxic elements such as Aluminum, Manganese elements remains. Because of this major crop like faba bean, did not get essential nutrients which are valuable for their growth. In order to alleviate this problem the experimental research conducted in the strongly acidic area of Banja district.

1.1. Statement of the problem

Some of the well-known areas severely affected by soil acidity in Ethiopia are Ghimbi, Nedjo, Hossana, Sodo, Chencha, Hagere-Mariam and Awi Zone of the Amahara regional state [6]. Despite this, no well-recorded documents are available describing the magnitude and extent of soil acidity in the country. In Awi zone the soil is strongly acidic and it could not produce faba bean. The yield of faba bean in this area distort due to the acidity of the soil. Even though soil acidity is identified as an issue requiring urgent attention in the western part of Ethiopia, information on the effect of land use type and management practices on soil fertility parameters in the country, particularly, Awi zone is very limited. The causes and extents of the problem in that specific area has not been identified and quantified. As the result of this knowledge gap, farmers remain with one or two relatively acid tolerant crops to sustain their life and the problem is continuing. Productivity of most cereals is low and yield reduction becomes frequent. The low productivity of crops of faba bean in that area exposes the farmers to food scarcity and indebtedness with credits as well as seasonal labor. The reasons for the yield reduction associated with soil acidity and management practices that help to overcome soil acidity and/or aggravate acidity problems are not clearly identified and described. Farmers and development agent didn't know the existence of acidic soil in the area until recent years, because there is no visible specific symptom on the crop, except reduction in yield. Moreover, no one identifies which land use type is more acidic. Likewise, soil properties, such as exchangeable acidity, acid saturations, pH, exchangeable bases, CEC texture, available P, available K, total N and organic matter of the soil and their relationships to soil acidity have not been analyzed and quantified. This study tries to full fill the gap of knowledge in soil acidity problems in the study area. The western and southern parts of Ethiopia, are dominantly covered by soils with pH<5.5[5]. In this area, the annual rainfall exceeds to potential evaporation/ET/. Similarly, the soils in areas such as Nedjo, Diga, Gimibi and Bedi in Oromiya, Chenchaa nd Sodo in southern nation's nationalities and peoples, and Gozamin and Senan Woreda in Eastern Gojjam and Awi zone inWest Amhara region have acidic problems in the soil [6]. Particularly, the highly weathered and leached Acrisols of Awi Zone Injibara have strong acid reaction (4.81) [7]. In Ethiopia, huge surface areas of highlands located at almost all regional states of the country are affected by soil acidity. According to [5], about 40.9 % of the Ethiopian total land is affected by soil acidity. About 27.7 % of these soils are dominated by moderate to weak acid soils (pH in KCl) 4.5 -5.5, and around 13.2 % by strong acid soils (pH in KCl) <4.5). The main soil forming factors giving rise to increase soil acidity in Ethiopia involve climatic factors such as rainfall, temperature, topographic factors, morphological factors and severe soil erosion [7].Nitisol/Oxisol zones are the main soil classes dominated by soil acidity. These soils are predominantly acidic and have been found that more than 80% of the landmasses originated from Nitisol are acidic .Presently; soil acidity has grown in scope and magnitude across different regions of Ethiopia. The effect of soil acidity in these regions have caused mineral stress and infertility in the soil which can be attributed to excess aluminum or iron or manganese on the one hand, and to deficiencies of N. P, K, Ca, Mg and host of micronutrients on the other

[7]. Among the various opportunities sought to increase agricultural development, exploitation of degraded lands devoid of crop production as consequence of soils acidity is one of the area of priority to tackle. The research and development approaches used so far gave little attention to this threatening problem and unable to develop an integrated solution to check its progress. As a result, the extent of the problem has increasingly grown in its scope and intensity and need for urgent solution to minimize its adverse impact and foster its contribution to the country's food security and poverty eradication efforts. The poor root growth leads to reduced water and nutrient uptake, and consequently crops grown on acid soils are confronted with poor nutrients and water availability. The net effect of which is reduced growth and yield of crops [8] . In Ethiopia, faba bean is cultivated in the "Wayina Dega" Zone (with altitudes 1800 to 2200 m a.s.l., average annual rainfall of 740 mm and mean daily temperature of 18 to 22°C) and "Dega" Zone (with altitudes >2200 m a.s.l, average annual rainfall of 900 mm and mean daily temperature of 10 to 18°C). It is grown from June to December in rotation with cereals. The national total area and production of faba bean in the year 2000 accounted for about 42624 ha and 4528.4 tones, respectively.4.51% of the total crop area in Ethiopia are covered by pulse crops [9]. It is a benchmark site for improvements of acidic soils in Amhara region. Crops like wheat, Faba bean and others are becoming less productive and have small area coverage than before in the area. Repeated plowing, high rainfall, topography and acidity of the soil among others can be mentioned as contributing factors. Soil acidity with associated low nutrient availability is one of the major constraints to faba bean production on Ethiopian highlands. Integrated use of organic and inorganic amendments is believed to reduce soil acidity and improve crop production. In Awi zone, Banjia district is one of the known areas which were degraded by soil acidity. This was identified by pH test of the soil before sowing faba bean .According to the laboratory result the soil pH of the study area Sankit Lideta was 4.6 and Exchangeable Acidity was 0.843.This indicated that the area was found in a strongly acidic zone. By depending on pH test, this study aimed to see the effects of lime on faba bean productivity by using five levels of lime. Therefore, this study was initiated with the following objectives.

1.2. Objectives of the study

General objective

The general objective of this study were to know the effects of lime on faba bean yield ,optimum lime requirements of faba bean per hectare of farm land and the effect of lime on faba bean plant growth and physiology.

Specific objective

The specific objectives of this study were;

- To determine the effects of liming on yield and yield components of faba bean per hectare of farm land
- To distinguish the optimum lime requirement of faba bean yield per hectare of farm land in Sankit Lideta .
- To assess the effect of lime on plant growth and physiology.

1.3. Research questions

The researcher tried to answer the following basic questions.

1. How much lime is required for maximizing yield of faba bean per hectare of farm land per year time in the study area?
2. What are the optimum lime requirements of faba bean yield per hectare of farm land in the study area?
3. What are the effect of lime on faba bean plant growth and physiology per hectare of farm land in the study area?

1.4. Significance of the study

It will develop the knowledge of the professionals and encourages them to solve the problems of Faba bean in the acidic areas. Moreover, the farmers have brought better living standard and they can acquire maximum fababean production.

It would be an input for other researchers to conduct further research and to solve the problem of faba bean in the acidic areas and the research would help the farmers to solve this problem. In addition; it helps the farmers to improve their awareness of soil protection and mechanism that help to increase faba bean production.

1.5. Delimitation of the study

The study was geographically delimited to Awi Zone Banja district Sankit Lideta which was severely affected by acidic soil. Conceptually, it was delimited in assessing the factors that affect faba ban productivity in the study area and applied five levels of lime for improving the productivity of faba bean in the strongly acidic soils.

1.6. Limitation of the study

The study did not consider all of the areas which were found in Awi zone. The study was focused mainly in Banja District Sankit Lideta.Pawi Agricultural Reserch Center was very far from the study area about 150 Km and the laboratory was done in the research center as a result, the researcher suffered a lot because of the constraints of finance and time. Moreover, there was no adequate review literature, references because the study was new.

1.7. Hypothesis

1. Liming reduces soil acidity and increases faba bean productivity.

2. Variation in amount of lime application results in variation in yield of faba bean.

3. Variation in amount of lime results in variation in faba bean Biomass yield, plant height, 50% flowering of faba bean, Number of seeds per plant of faba bean, Number of pods/plant.

3. Materials and methods

3.1 Description about the study area

3.1.1 Location

The study was conducted in Banja Woreda, specifically Sankit lideta Awi Administrative zone, Amhara Regional State, Ethiopia. The study area lies within geographically, $10^0$52’’to 11^0 3’’N latitude and $36^0$38’’ to $37^0$8’’E longitude at a distance of 440 km North West of Addis Ababa and 120 km south east of Bahir Dar, the capital of Ethiopia and Amhara regional state, respectively. In the current administrative structure, Awi Zone has seven main administrative Woredas:Banjia ,Ankesha, Fagtalekoma, Dangila, Guangua, Guagusashekuadad ,and Jawi. Banja was selected for the fact that: soil acidification, is critical and burning issue requiring urgent attention in the area .In relation to this problem faba bean productivity has been declined. Probable causes, acidity levels and optimum lime requirement not yet assessed and evaluated

3.2. Research design

This study was quantitative research which was conducted in Banja district sankit lideta and the experimental lay out was established. There was preparation of areas which had 18m *24m and the area was divided in to three blocks .Each block had five plots so the total plot was 15 .The replication and treatments were 3 and 5 respectively. The preferable research design for this research was Random complete blockade design (RCBD). Replications of treatments are assigned completely at random to independent groups of experimental subjects within blocks each treatment is repeated more than once per block. Randomization indicates each unit was supposed to have the same chance of receiving a particular treatment. Statically the randomization procedure allows elimination of bias and ensures the computation of valid sampling errors. Block is a relatively large area or several identical units receiving all or most of the treatments. Generally the characteristics of RCBD are the presence of equally sized blocks, each containing all of the treatments; the allocation of treatment in block was done independently of other blocks. Moreover the total sources of variation were categorized by differences between blocks, differences between treatments and interaction between blocks and treatments and RCBD are constructed to reduce noise or variance in the data. The experiment was laid out in randomised complete block design (RCBD) arranged in a complete factorial with five levels of lime application replicated three times. The amount of lime that were applied at each level calculated on the basis of the mass of soil per 20 cm hectare-furrow-slice, soil sample density and exchangeable Al^{+3} and $H^{+1}$of each site as described.

$$\text{LR, CaCo3}_{\text{(Kg/ha)}} = \frac{\text{c mo/EA/kg of soil}*0.15\text{m}*10^4\ \text{m}^2\ *\text{B.D (Mg/M}^{3)}*1000}{2000}$$

3.3. Experimental Layout and treatment application

The study was conducted at Sankit lideta which was found in Awi zone in Amhara regional state. For this study layout established and prepared fifteen plots .The field experiment was laid out in a Randomized Block Design having three replications. The size of the gross plot was 4M x 5M m and net plot 3.2m x 5 m .Five levels of lime were replicated three times and the area of each plot was $20m^{2.}$ Five levels of lime were introduced. In the first level no lime added to neutralize the exchangeable acidity of the soil (control point). In the second level 1150 kg/ha lime used to neutralizes the exchangeable acidity of the soil. In the third level 2300 kg/ha lime used to neutralize the exchangeable acidity of the soil. In the fourth level 3450 kg/ha lime used to neutralize the exchangeable acidity of the soil. In the fifth level 4600 kg/ha lime, used to neutralize the exchangeable acidity of the soil. Lime was broadcasted uniformly by hand and incorporated into the soil at least a month before planting. Urea and triple super phosphate had been used as the source of N and P, respectively and faba bean variety was CS -20-DK.

3.4. Methods of data collection

The experiment was conducted in Banjia district specifically sankit lideta because the area is found in acidic soil. Soils which existed in sankit lideta become acidic and not favourable for major crops such as faba bean. So, this work was intended to solve the problems of faba bean by introducing five levels of lime .So to see the effect lime on faba bean yield and to assess whether liming improves soil acidity primary data were collected for about five months. Data had been collected from 22/10/2003-10/4/2004 E.C on plant bases following the day to day physiological change of the plant .Moreover, observation was contributed to follow its change and to take the necessary data on time. Therefore, the following data were collected.

1. Stand count at emerge-- The emerging plants in each plot counted on the harvestable area by excluding the border and the data collected on plot base.

2. 50% flowering Plants were observed daily for flowering. The day on which 50 percent of plants showed flowers in the plot was considered as 50 per cent flowing .The number of day taken from the date of sowing to flowering was calculated and expressed in number as days taken for 50 per cent flowering. The data was taken on plot bases.

3. Plant height- Plant height data were collected on plant bases randomly taking five plants, measuring its height and took the mean. The plant height on five randomly selected and tagged plants were measured from the base of the plant to the tip of the shoot apex and at harvest. The average height of five plants found out and expressed in centimeters and the data was gathered on plant bases.

4. Days to 50% maturity- The day on which 50 % of plants showed maturity in the plot were considered as 50 % maturity. A number of days taken from the date of sowing to maturity was calculated and expressed in number as days taken for 50 % maturity and the data collected on plot bases.

5. Lodging (stalks %) – The data that showed the plants level of bending were taken in each plot through observation and measured by percentage and it was collected on plot bases.

6. Days to 95% maturity - The day on which 95 % per cent of plants showed maturity in the plot was considered as 95 %. A number of days taken from the date of sowing to maturity was calculated and expressed in number as days taken for 95 % maturity and it was collected on plot bases.

7. Number of pods / seed – A number of seeds from five randomly selected were taken and plants in each treatment were counted and the average found out and expressed as number of seeds per pod.The data collected on plant bases.

8. Number pods/plant -A number of pods harvested from five randomly selected and tagged plants in each treatment was counted and average found out and expressed as number of pods per plant. The data collected on plant bases.

9. Number of seeds/plants- A number of seeds harvested from five randomly selected and tagged plants in each treatment was sun dried and the seeds were separated. The average was worked out and expressed as seed yield per plant in grams. It was collected on plant bases.

10. Stand count at harvest- Faba bean plants which were found at harvest counted on the harvestable area by excluding the border and expressed by number and it was collected on plot bases.

11. Biomass yield (kg/ha) –The total weight of the plant measured in each plot by excluding the border Converting plot biomass yield to hectare basis. The data collected on plot bases.

12. Grain yield (kg/ha) - The net weight of the faba bean yield measured in each plot converting plot grain yield to hectare basis. So, the data were collected on plot bases.

Generally this study was conducted by following necessary guide lines ;- such as, the spacing between plants was 5 cm, spacing between rows 40 cm, plot size $20m^2$, harvestable rows was 8 , replication 3 treatments 5 and harvestable area $16m^2$.

3.5. Method of Data Analysis

The data which were collected during the experiment was quantitative data. The data were recorded by data sheet appropriately and the data was expressed in number. The data that were taken during the study as follows;- stand count at emerge, stand count at harvest were collected by counting the plant and expressed in number. The data 50% flowering, 50%maturity, 95%maturity was taken by following the physiology of the plant and took the number of days. The data for number of seed per pod, number pod per plant, number of seed per plant were collected by taking the mean. Lodging data was taken by percentage (%). Plant height data was taken by measurement (cm) and expressed in number. Biomass yield and Grain yield data were obtained by converting plot grain yield and biomass yield to hectare basis and expressed in kg per hectare hectare(kg/ha).To analyze these data Statically Analysis Software(SAS) version 9 were introduced .This work assessed the effect of lime on faba bean plant growth and physiology, the dependant variable faba bean yield and independent variables lime, CV(%), mean, R-square ,correlation coefficients ,and Degree of freedom analyzed.

4. Results and Discussion

4.1. The Effects of Lime on Growth of Faba Bean

The research design was random complete blockade design and it was conducted in the field. Moreover the experiment was laid out in randomised complete block design (RCBD) arranged in a complete factorial with five levels of lime application replicated three times. The amount of lime that were applied at each level calculated on the basis of the mass of soil per 20 cm hectare-furrow-slice, soil sample density and exchangeable Al^{+3} and $H^{+1}$of each site as described. The data were collected from each treatment and analyzed according to the objectives and leading questions of the research. The data analyzed according to the effect of lime on the acid properties of soil and faba bean yield in Sankit Lideta Awi Zone and the result expressed below.

Table 1: Effects of lime on plant height, Number of pods/plant, Number of seeds/pod, Number of seeds/plant.

Lime (kg/ha)	Plant height(cm)	No. pods/plant	No. of seeds /pod	No. seeds /plant
0	84.6C	4.40C	1.60A	8.8B
1150	101CB	7.53B	1.93A	16.3AB
2300	101.6CB	6.53B	1.80A	12.80AB
3450	119.66AB	9.93A	2.06A	18.13A
4600	129A	7.93AB	2.13A	15.93AB
CV (%)	10.57	15.12	17.02	25.50
R-Square	0.78	0.80	0.55	0.70
Mean	107.2	7.26	1.90	14.36
Degree of freedom	6	6	6	6

Significantly different $p<0.05$

Plant height

There was significant difference($p<0.05$) of lime application on plots as lime rate increased the plant height also increased by 19.4%, 20.2%, 41.4%, 20.2%, 41.4% and 52.5% respectively over the control. This indicated that liming increases the plant height .There was variation in plant height because of variation of lime amount. It was in supported by [10] who found that liming would have its effect on plant height improvement.

Number of Pods per plant

There was significant difference ($p< 0.05$) of lime application on number of pods per plant. The highest number of pods /plant was 9.93 which were recorded by 3450kg/ha, of lime. However, the lowest number of pods /plant was recorded by the plot without lime .This indicated that lime application increased number of pods per plant. Moreover, there was variation in number of pods per faba bean plant due to variation in amount of lime. When we add more amount of lime the pH value of the soil have been improved and the key caution Ca, p,k,Mg, increased in the soil .Moreover the appearance of faba bean disease and leaching would create inconsistence on the number of pods per plant. The result of this finding was in agreement with [11] indicated that liming has improved the number of pods per plant. [11] Moreover, he found that liming improves the number of pods /plant.

Number of Seeds per pod

There was no significant (P=0.05) difference in lime application on number of seeds/pod .However , the highest number of seeds /pod was 2.13 which was recorded by lime level of 4600 kg/ha .The lowest number of seeds /pod was recorded without lime application. This indicated that liming did not bring significant difference on the number of seeds /pod. Even if there was variation on seeds per pods from 0kg/ha to 4600kg/ha lime the difference was not due to application of lime. Moreover genetics and environment have an impact on number of seeds per pod of faba bean plant. The result of this finding was not agreed with [11] found that reduction of number of seeds /pod but in this work there was no significant change. According to [10] the number of seeds per pod did not show any significant effect.

4.2. Number of Seeds per plant of faba bean

There was significant difference ($p<0.05$) of lime application on the number of seeds per plant. The highest number of seeds per plant was 18.13 which were recorded by 3450kg/ha and the lowest was 8.8 which were recorded by plot without lime application. There was variation in number of seed per pod because of variation in amount of lime .This indicated that liming had increased number of seeds per plant. These findings are Consistent with [10] who found that liming have improved the number of seeds per plant.

Table 2: Effects of lime on stand count at Emergence, harvest and lodging percent

Lime level(kg/ha)	Stand count at emerge	Stand count at harvest	Lodging (%)
0	674.67A	235A	38A
1150	593.67A	236.67A	58A
2300	587A	258A	52.6A
3450	577.3A	227.3A	68.3A
4600	623.3A	249.6A	58A
CV (%)	11.16	39.72	56.17
R-Square	0.51	0.31	0.16
Mean	611.20	241.4	55
Degree of freedom	6	6	6

Non significant $p_= 0.05$

Stand count at Emerge, Stand count at Harvest and Lodging (%). There was no significant ($p=0.05$) difference of lime application on stand count at emerge and harvest. However, the highest stand count was recorded in which lime was not applied that was 674.67 the lowest was 577.3 in which 3450kg/ha lime was introduced.

Moreover, the highest stand count harvest was recorded 258 in which 2300kg/ha lime was used and lowest was 227.3 in which 3450kg/ha lime was introduced. In addition, lodging was not bringing significant difference.

Table 3: Effects of lime on days to 50% flowering, 50% maturity, and 95%maturity.

Lime(kg/ha)	Days to 50% flowering	Days to 50% maturity	Days to 95% maturity
0	53.6A	66.67A	80.3A
1150	53AB	66AB	83.3A
2300	52.6A	66.3AB	83.0A
3450	53.3AB	66.3AB	83.66A
4600	52.3B	65B	83.66A
CV (%)	1.16	0.78	21.8
R-square	0.61	0.62	0.53
Mean	53	66.13	82.8

Non significant P=0.05

50% Flowering

There was significant difference (p<0.05) in days to 50% flowering on the crop. As lime rate increased from 0 to 4600kg/ha there was decrease in days to flowering except at 3450 kg /ha lime level .The shorter day was 52.3 which was recorded by 4600kg/ha lime level. However the longer day 53.6 was recorded because of the absence of lime. This indicated that when we add more lime the duration of flowering would become shorter and those treatments which didn't have lime become delayed in flowering time. Moreover liming would have brought significant difference on days to flowering. The variation in amount of lime had brought a difference in days to 50% flowering. 50% Maturity and 95% Maturity There was significant difference (p< 0. 05) in days to 50% maturity but there was no significant (p=0.05) difference of lime application in days to 95% maturity. As the lime rate increased from 0 to higher level days to 50% maturity shortened. The shorter days was 65 which was recorded by the plot with the highest level of lime .However, the longest day was 66.67 which was recorded by the plot without lime. These findings were Consistent with [10] who found that liming would facilitate the maturity level of the plants.

4.3. The Effects of Lime on Yield of Faba bean

Table 4: Effects of Lime on above ground Biomass yield (kg/ha) and grain yield (kg/ha) on faba bean.

Lime(kg/ha)	Above ground Biomass	Grain yield
0	1822.9B	1025.16B
1150	2822.9B	1256.8AB
2300	3710.4AB	1804.1AB
3450	3489.6AB	1731.3AB
4600	5108.3A	2163.8A
CV (%)	32.02	29.8
R-Square	0.66	0.58
Mean	3390.83	1596.2
Degree of freedom	6	6

Significantly different $p < 0.05$

Biomass Yield

There was significant difference ($P<0.05$) in the total above ground biomass (TABG) of faba bean as the lime rates increased. As the lime rates increased, total above ground biomass increased by 54.8%, 103.54%, 91.4%, and 180.2% over the control. This reveled that liming had brought significant difference on the biomass yield. The variation in lime amount had brought a variation in biomass yield weight in different treatment. These findings were Consistent with [12] who revealed that liming have direct relation with biomass yield.

Grain yield

Lime was significantly increasing grain yield over the control ($P <0.05$). As the lime level increased from 0 to the highest level of lime, the increment in grain yield was 18.4, 76, 68.8 and 111 percent over the control .This indicated that liming would have improved grain yield of faba bean. According to this finding the optimum lime requirement for faba bean productivity was 4600kg/ha in farm land. Moreover, the variation in amount of lime had created a variation in yield of faba bean .Adding lime reduces acidity and increased the yield of faba bean more than double according to this study .These findings were Consistent with [13] who found that liming enhances productivity of faba bean. Increased soil acidity may lead to reduced yields, poor plant vigor, uneven pasture and crop growth, poor nodulation of legumes, stunted root growth, persistence of acid-tolerant weeds, increased incidence of diseases and abnormal leaf colors are major symptoms which indicate soil acidity problem [5].This study supported the scholars finding in which to improve the productivity of legumes crops like faba bean in the strongly acidic areas lime played a pivotal role to enhance the yield of faba bean .

5. Correlation coefficients (CV %)

The correlation coefficient for faba bean was positive with plant height, number of seeds /plant, number of pods/plant, biomass yield, 50% maturity .Therefore increase in these traits would ultimately increase the grain yield. However, stand count at emerge, stand count at harvest and lodging did not show significant difference. [10] stated that liming have brought significant difference on number of pods/plant, number of seed/plant Significant differences among genotypes for characters , leaf area,, first pod height, days to 50% flowering, days to flowering completion, days to pod initiation, days to 50% maturity, plant height, number of pods per plant, grain yield.

6. Conclusion

As the lime rate increases if other factors keeping constant the grain yield increases. In addition, liming increases the productivity of faba bean in the study area sankit lideta. According to this experiment to solve the problems of fababean in the study area and to improve its productivity the optimum lime requirements was 4620kg/ha and for the source of N, and P 39.13kg Urea/ha and 100kg TSP/ha had introduced respectively. As the lime level increased from 0 to the highest level of lime 4600kg/ha, the increment in grain yield was 18.4%, 76%, 68.8% and 111 % .As lime level increased from 0 to 4600 kg/ha the grain yield, biomass yield, plant height had also brought significant difference .There was significant ($p < 0.05$) difference in days to 50% maturity but there was no significant ($p=0.05$) difference of lime application in days to 95% maturity. As lime rate increased from 0 to 4600kg/ha, there was decrease in days to flowering except at 3450 kg /ha lime level. According to this study the highest grain yield of faba bean was 2163.8kg/ha which was recorded by the highest level of lime (4600kg/ha).However the experiment was conducted from June to September would be repeated over seasons, location and other varieties. More over the increase in lime application had direct relation with the increase in height, number of seeds/plant, Number of pods/plant, biomass yield and grain yield .However number of pods /seed, 95% maturity and lodging did not have brought direct relationship. Generally, liming reduced soil acidity and boost faba bean yield. The variation in lime amount brought significant difference in grain yield ,biomass yield, plant height, days to 50 % flowering, days to 50% maturity .However, variation in lime amount did not bring significant difference in number of seeds /pod, days to 95% maturity, stand count at harvest, stand count at emerge and lodging.

7. Recommendation

Based on the finding of the study, the following recommendations are given

- As lime rate increases if other factors keeping constant, the faba bean grain yield increases. In order to solve the problems of faba bean in the study area and to improve its productivity the optimum lime requirement was 4600kg/ha, and for the source of N and P 39.13kg Urea/ha and 100kg TSP/ha had introduced respectively.
- The farmers should take measures to solve the problem by themselves using manure, protecting their farms, crop rotation, and monitor flooding.
- The government and nongovernmental organizations have also worked together to solve the problem of soil acidity and to maintain the fertility of the soil in Banja Awi zone. In addition, both of them must support financially, technically, morally those peoples who conduct research in solving the problem of acid soil and improving the productivity of faba bean.
- Professionals should take effective measure to alleviate the problem otherwise it will endanger the fate of the future peoples in the study area.
- During the research faba bean was affected different problems such as Chocolate spot caused by disease *Botrytis fabae* .The symptoms are reddish or chocolate brown spots on leaves and reddening of stems., leaf blight caused by bacteria, rust caused by fungus resulting in premature leaf drop which may reduce seed weight and size. Root roat accumulation of bacteria due to increasing of moisture in the root, Termites, Ascocyta blight caused by the fungus *Ascochyta fabae* were the main challenge of faba bean. So, these were other faba bean problems which were prevalent during the study time and it needs further research.
- The government should expand lime factory and encourage the farmers to use lime and increase the yield of faba bean in Banja district.
- According to this finding using 4600kg/ha lime integrated with 39.13kg/ha urea and 100TSP recommended for farmers in the study area to improve faba bean yield and productivity in Banja district specifically Sankit lideta .

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8. Appendiex . 1

Ethiopia Institute of Agricultural Reserch Pawe Agricultural Research Center pawe

Soil Analysis Laboratory Result delivery Sheet

Requested by- Ayalew Muluye

Sample Type soil Sample (before lime Application)

Sampling Date 04/09/2003 E.C

Date of request; July 2011

District- ,Banjia Site Awi zone

Date of analysis-August-November, 2011

Sampling Depth; 20cm

Table 5

Field No.	pH1;2.5 Soil to water Ratio	pH1;2.5 soil to KCl Ratio	AV.P BrayII (PPM)	AV.P Olson() ppm	Total Nitrogen Kjeldhal method(%	O.C Walkley Black (%)	O.C Walkley Black (%)
Ay-B1							
Ay-B2							
Ay-B3							

Table 6

Field No.	CEC NH4 OAC Method meq/100g of soil	Exchangeable Acidity Kcl Extraction Meq/100k of soil	Exchangeable Aluminum Kcl Extraction Meq/100g of soil	Exchangeable cations NH4OAC method Meq/100g of soil	
				k	Na
Ay-B1					
Ay-B2					
Ay-B3					