CHAPTER 5

RESULTS OF FIELD EXPERIMENT

5.1. Effect of phosphorous fertilizer and lime on number of nodule

Analysis of variance results (Table 11) indicated that there was strong significant interaction between phosphorous fertilizer and lime application rates found for number of nodule at R_4, R_6 and R_8 stages ($P<0.01$). There was however, no significant interaction between phosphorous fertilizer and lime application rates at R_2 stage. Significant differences of nodule number also were found between phosphorous fertilizer and lime application rates at all growth stages.

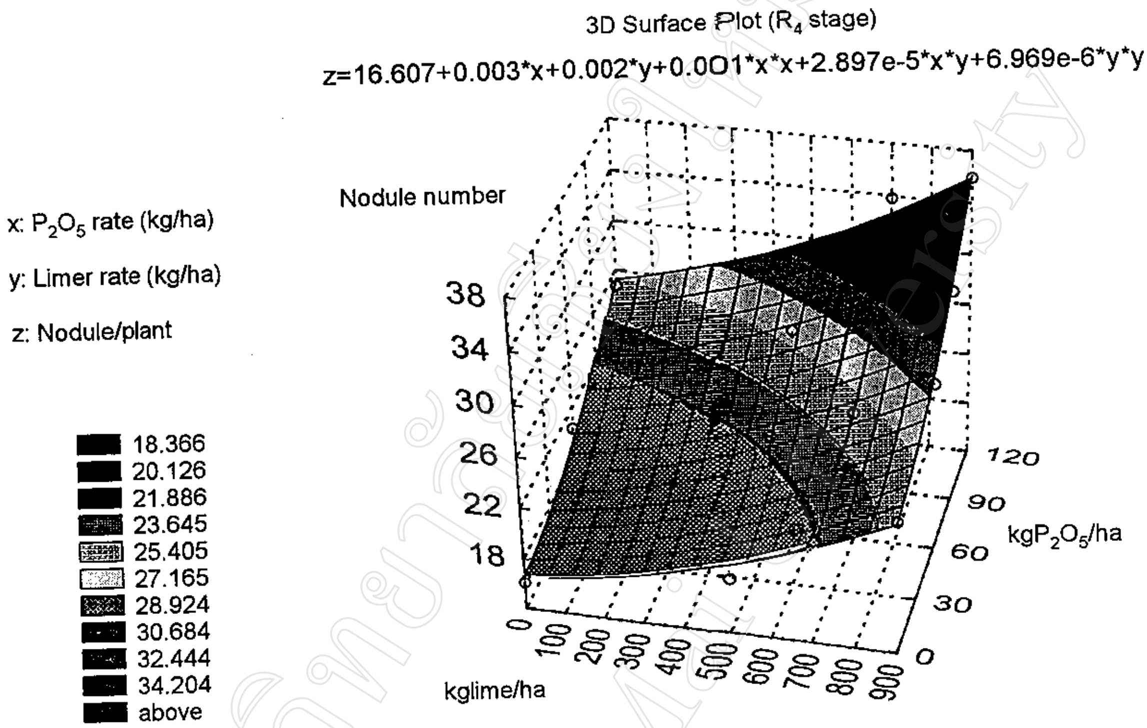
Table 11: Analysis of variance for number of nodule

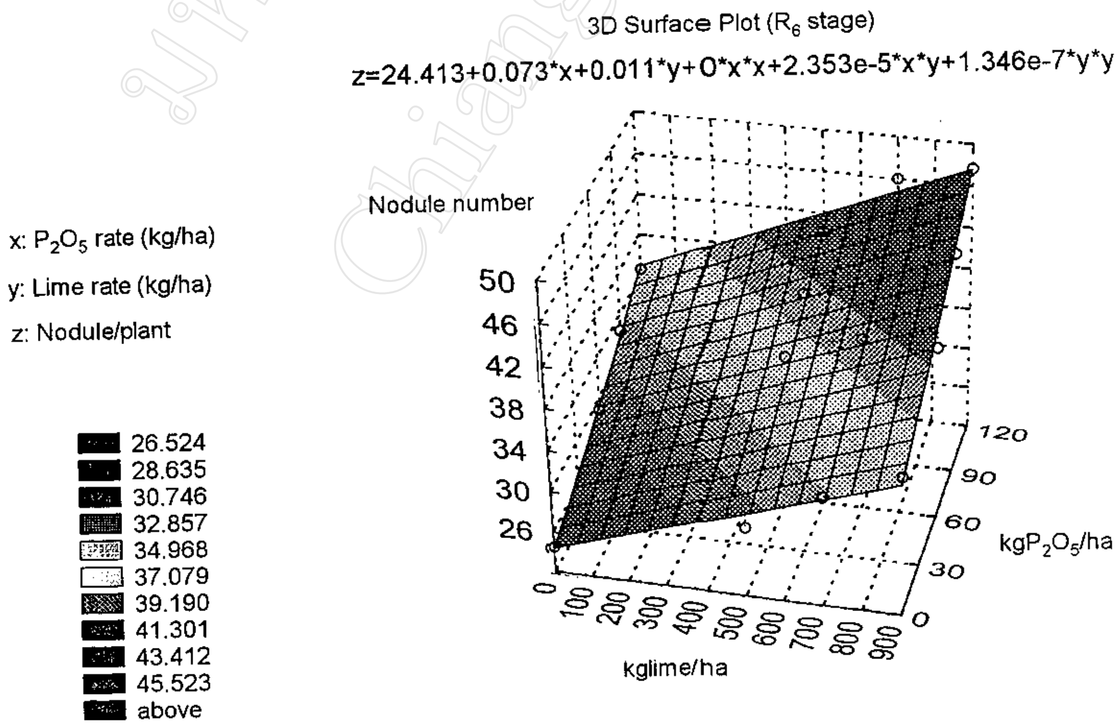
Source of variation	Significant level of growth stages			
	R_2	R_4	R_6	R_8
Replication	ns	ns	ns	ns
Lime (L)	* *	* *	* *	* *
Phosphorous (P)	* *	* *	* *	* *
P x L	ns	* *	* *	* *
CV (%)	27.42	20.69	16.56	18.14

** indicates significant at 0.01% level

ns indicates not significant

Figure 9 showed the response of nodule number per plant to phosphorous fertilizer and lime application rates at R_4, R_6 and R_8 stages. It reveals that number of nodule per plant increased with increasing phosphorous fertilizer. Increasing lime application rate also enhanced number of nodule per plant. However, number of nodule increased greater with application of lime at 700 and 900 kg ha^{-1} at different phosphorous fertilizer rates application.





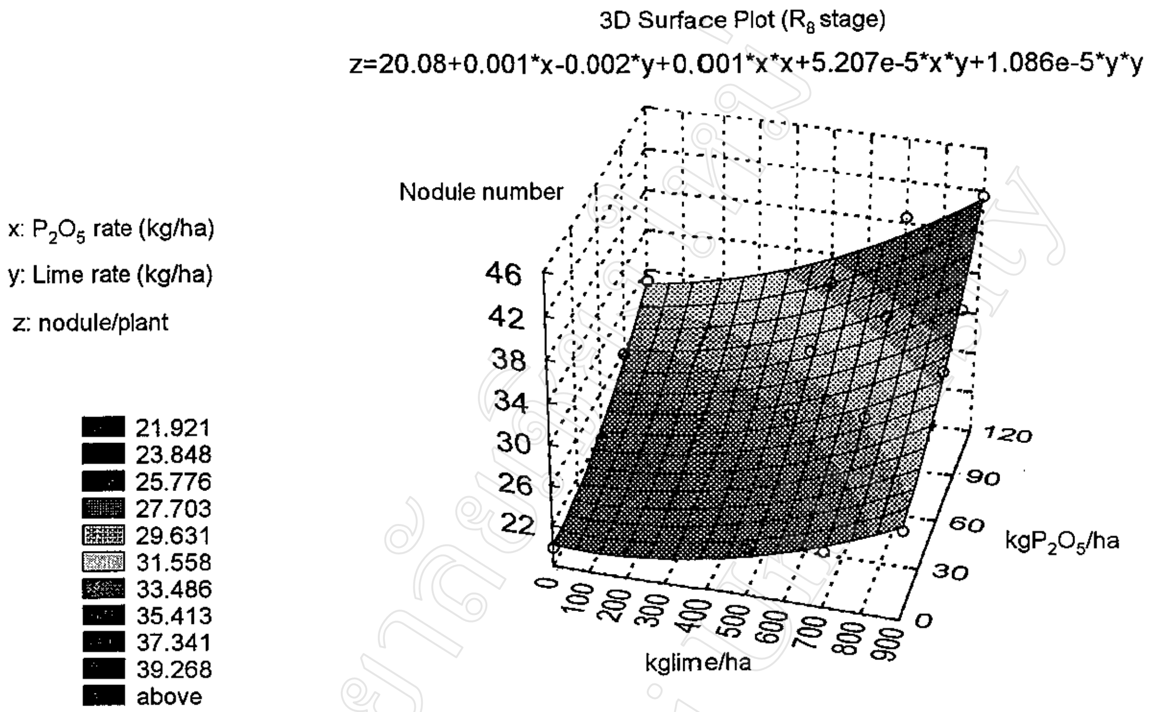


Figure 9: Effect of P fertilizer and lime on number of nodule at R_4, R_6 and R_8 stages

At R_4, R_6 and R_8 stages number of nodule per plant showed greater response when mixture of phosphorous fertilizer and lime was applied. The maximum number of nodule was found when phosphorous fertilizer at the rate of 120 kg of P_2O_5 ha^{-1} in combination with lime at the rate of 900 kg ha^{-1} were applied which was 47.9 at R_6 stage (80 DAS). Generally, it was found that applying phosphorous fertilizer and lime together would bring higher number of nodule per plant as compared with applying phosphorous fertilizer and lime separately. The lowest number of nodule per plant was 9.03 which was obtained in the plot with no phosphorous fertilizer and lime applied.

5. 2. Effect of phosphorous fertilizer and lime on nodule dry weight

The effect of phosphorous and lime on nodule dry weight was similar to number of nodule per plant (Table 12). There was significant interaction ($P<0.01$) between different phosphorous fertilizer and lime application rates at R_4, R_6 and R_8 stages. Significant difference of nodule dry weight was also found between phosphorous fertilizer and lime application rates at R_2, R_4, R_6 and R_8 stages.

Table 12: Analysis of variance for nodule dry weight

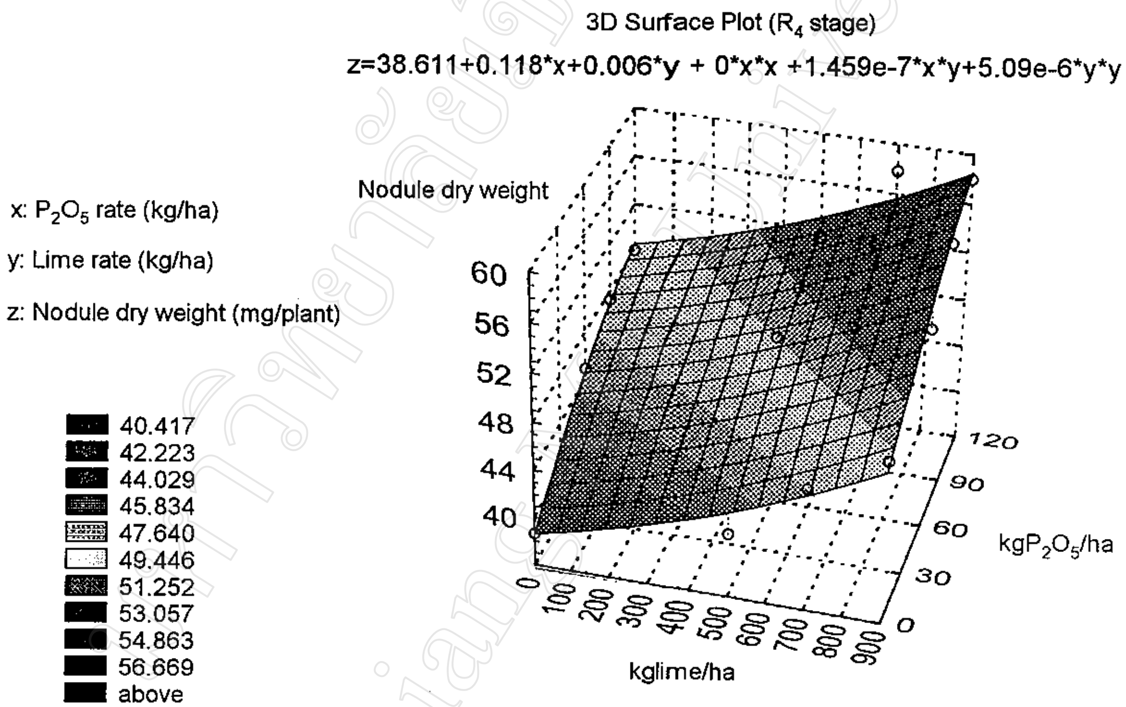
Source of variation	Significant level of growth stages			
	R_2	R_4	R_6	R_8
Replication	ns	ns	ns	**
Lime (L)	* *	* *	* *	* *
Phosphorous (P)	* *	* *	* *	* *
P x L	ns	* *	* *	* *
CV (%)	17.96	9.19	10.36	14.77

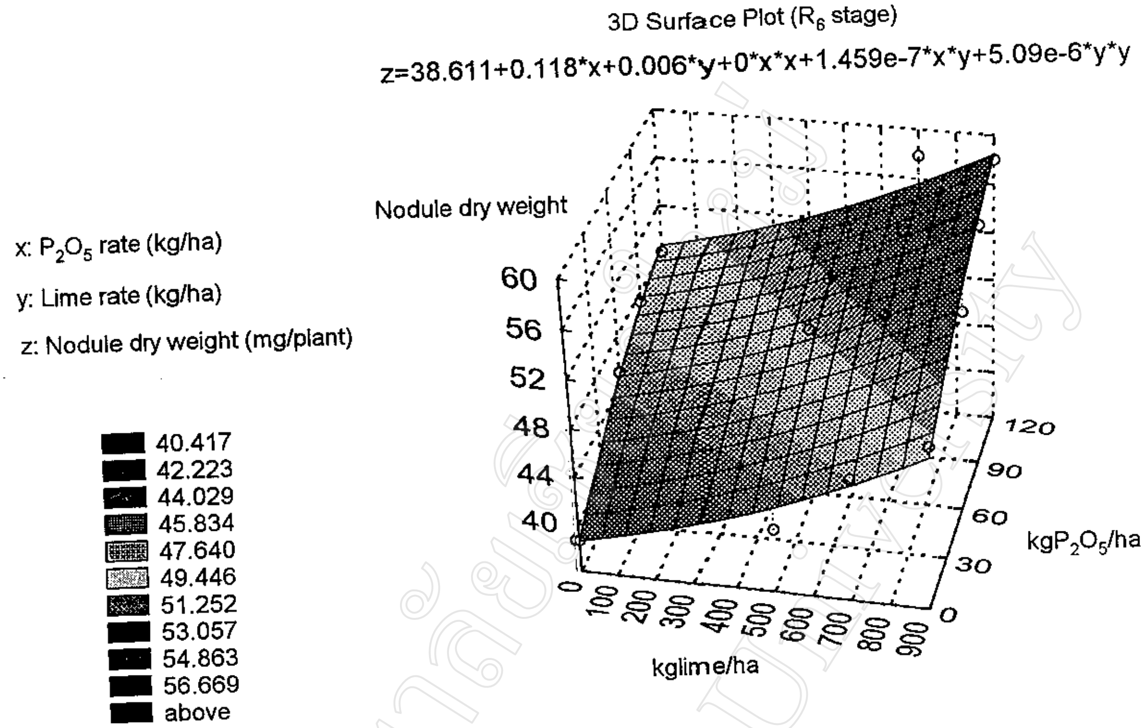
* indicates significant at 0.05% level

** indicates significant at 0.01% level

ns indicates not significant

It was observed that nodule dry weight increased as phosphorous and lime application rate increased (Figure 10). However, liming at 700 and 900 kg ha^{-1} in general showed greater response in nodule dry weight to phosphorous fertilizer than liming at 0 and 500 kg ha^{-1}. It was found that applying phosphorous fertilizer and lime together always resulted in greater nodule dry weight than applying phosphorous fertilizer and lime alone. At R_6 stage nodule dry weight show greatest response to phosphorous and lime application. At this stage the average nodule dry weight were 42.5, 48.7, 58.2 and 59.1 mg per plant with respect to 0, 60, 90 and 120 kg of P_2O_5 ha^{-1} applying with lime at rate of 900 kg ha^{-1}. The maximum nodule dry weight was also observed in treatments applying 120 kg of P_2O_5 ha^{-1} with 900 kg of lime ha^{-1} at R_6 stage. At harvest stage nodule dry weight decreased at all rates of lime and phosphorous fertilizer application as compared with R_4 and R_6 stages. The average nodule dry weight at R_8 stage was 31.8, 36.9, 46.2, and 48.3 mg per plant with corresponding to 0, 60, 90 and 120 kg of P_2O_5 ha^{-1} with 900 kg of lime ha^{-1} applied.





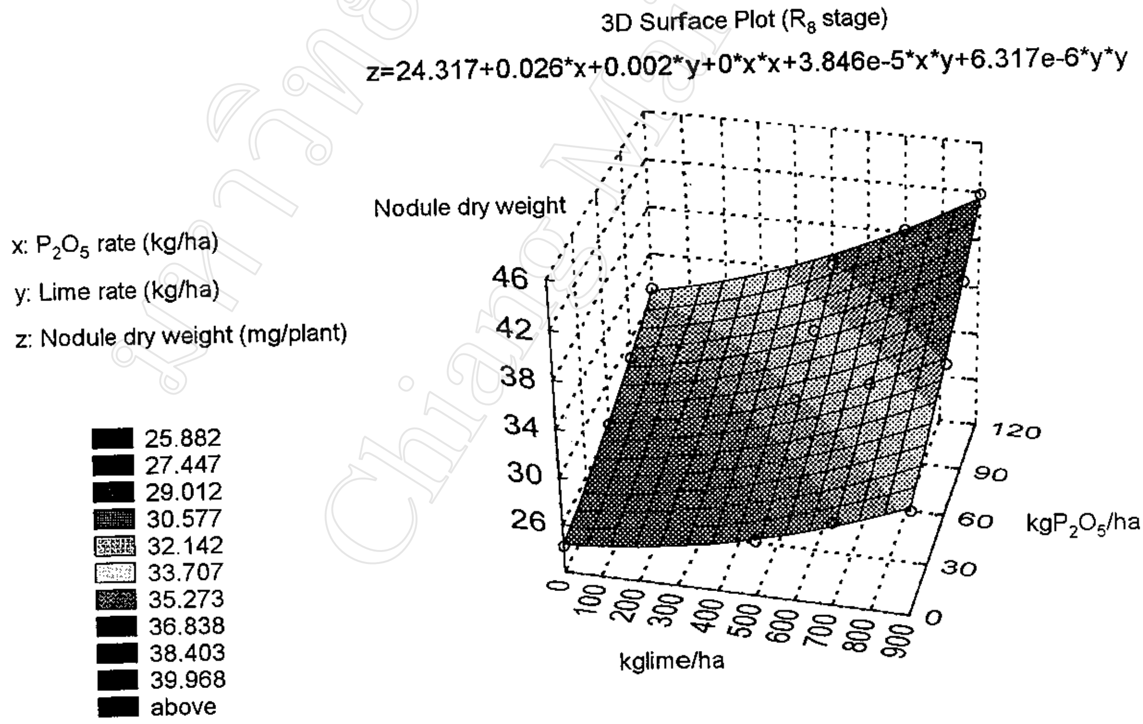


Figure 10: Effect of P fertilizer and lime on nodule dry weight at R_4, R_6 and R_8 stages

At R_2 stage (40 DAS), there was no significant interaction effect between phosphorous fertilizer and lime application on nodule dry weight. However, significant difference of nodule dry weight per plant was found in response to phosphorous fertilizer (Figure 11). Average nodule dry weight was 16.8, 18.7, 20.1, and 21.5 mg plant^{-1} with respect to 0, 60, 90 and 120 kg of P_2O_5 ha^{-1}. Similarly, there was significant difference of nodule dry weight per plant among four rates of lime application (Figure 12). The highest nodules dry weight was found at rate of 900 kg of lime ha^{-1} which was 21.0 mg/plant.

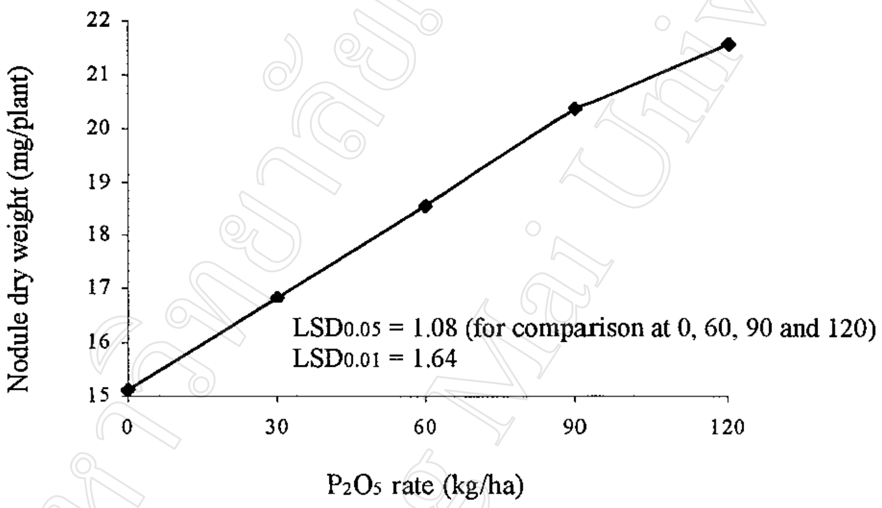


Figure 11: Effects of P fertilizer on nodule dry weight at R_2 stage

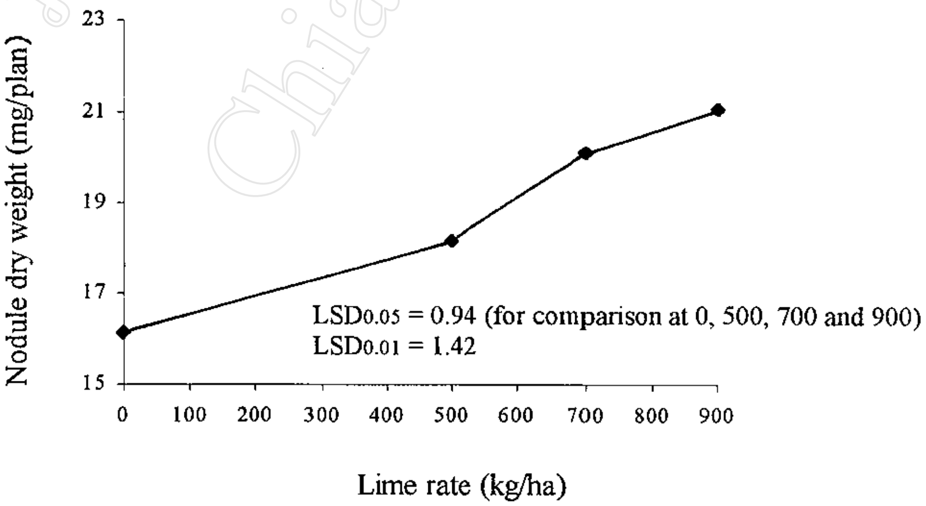


Figure 12: Effect of lime on nodule dry weight at R_2 stage

5.3. Effect of phosphorous fertilizer and lime on dry matter yield

Significant interaction between phosphorous fertilizer and lime application rates was found for dry matter yield at R_2, R_4, R_6 and R_8 stages (P <0.01) (Table 13).

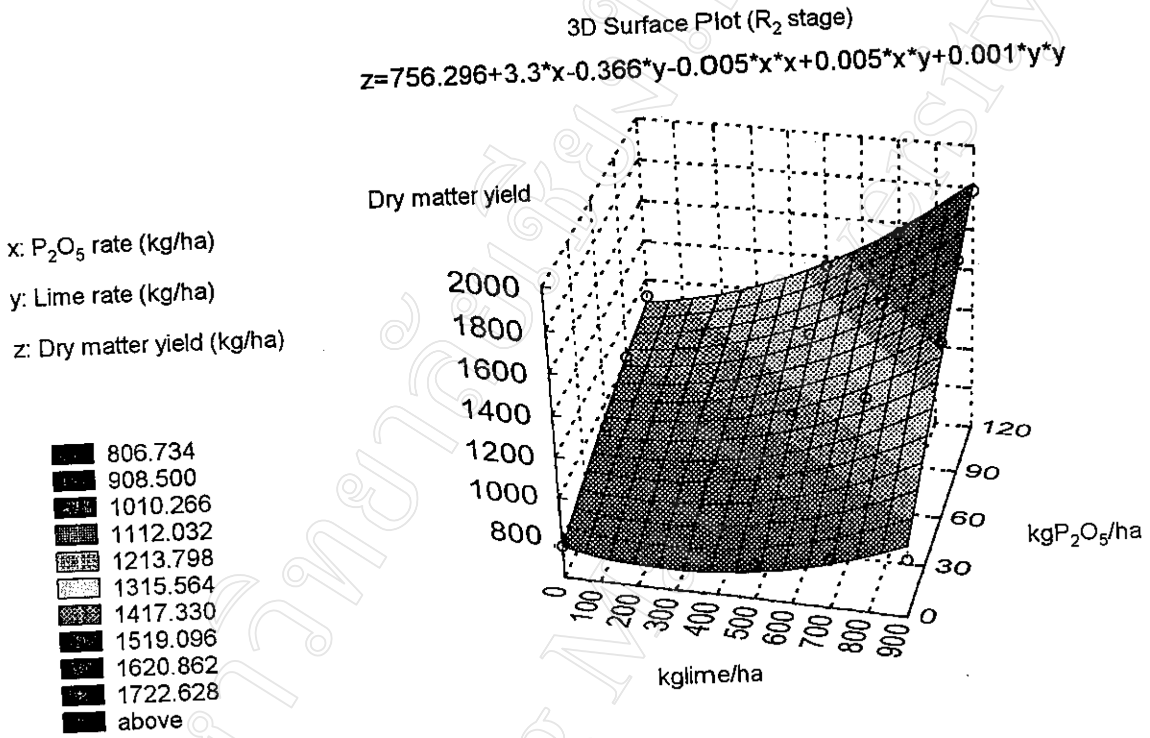
Table 13: Analysis of variance for dry matter yield

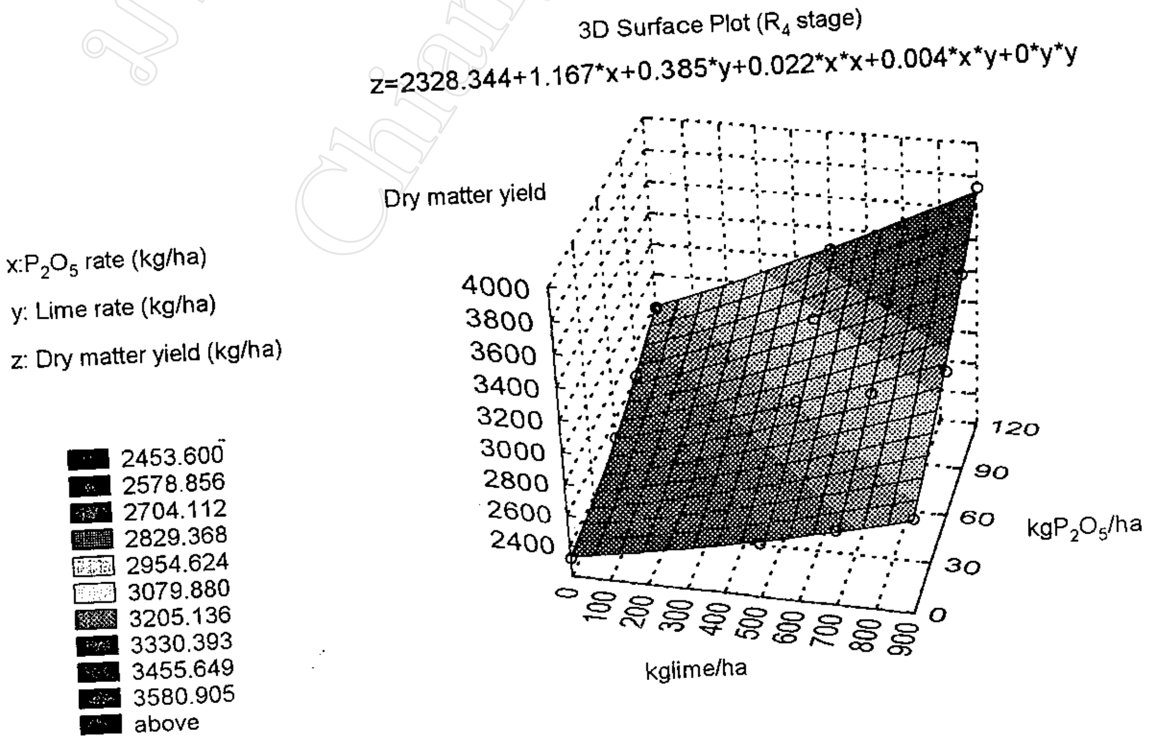
Source of variation	Significant level of growth stages			
	R_2	R_4	R_6	R_8
Replication	ns	ns	ns	* *
Lime (L)	* *	* *	* *	* *
Phosphorous (P)	* *	* *	* *	* *
P x L	* *	* *	* *	* *
CV (%)	26.85	16.58	18.89	11.13

** indicates significant at 0.01% level

ns indicates not significant.

It was also found that dry matter yield of peanut increased significantly as phosphorous fertilizer and lime application rates increased (Table 13). Dry matter yield of peanut at R_2, R_4, R_6 and R_8 stages was affected considerably by significant interaction effect between phosphorous and lime (Figure 13). In general, results demonstrated that dry matter yield positively increased when phosphorous fertilizer rates were added together with lime. Dry matter yield accumulation was almost doubled at 60 DAS (R_4 stage) as compared with 40 DAS (R_2 stage). Application of 60, 90, 120 kg of P_2O_5 ha^{-1} increased dry matter yield at higher rate in presence of lime as compared with without lime application. For instance, at harvest stage applying 90 kg of P_2O_5 ha^{-1} and 700 kg of lime ha^{-1} separately increased dry matter yield by 20.5% and 19.2%, respectively, whereas application of phosphorous and lime together increased dry matter yield by 44.6%. The highest dry matter yield was found at application rates of 120 kg of P_2O_5 ha^{-1} and 900 kg of lime ha^{-1} at harvest stage which was 6,789 kg ha^{-1}. And the lowest dry matter yield was observed at control treatment which no phosphorous fertilizer and lime were applied which was 4,399 kg ha^{-1}.





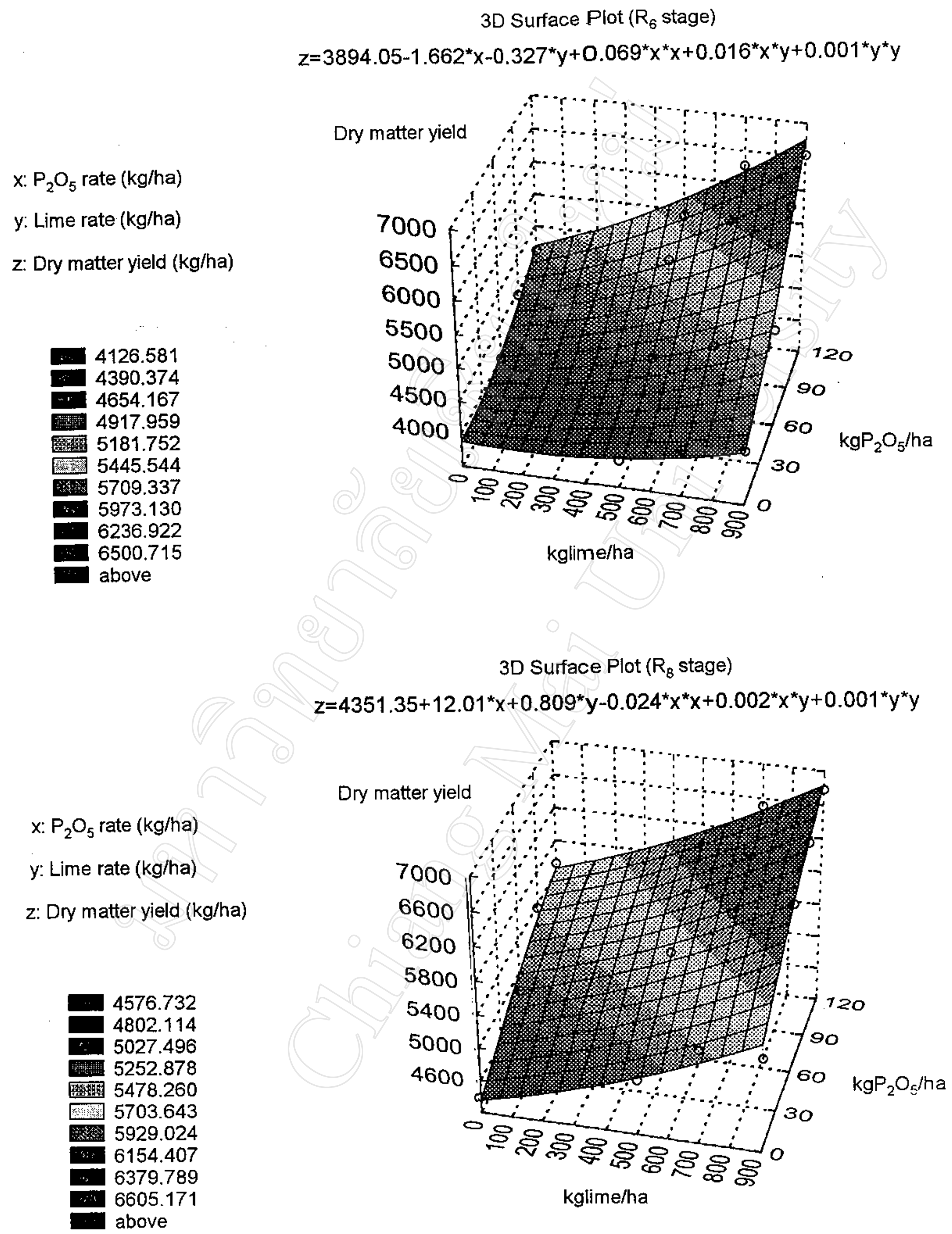


Figure 13: Effect of P fertilizer and lime on dry matter yield at R_2, R_4, R_6 and R_8 stages

5.4. Effect of phosphorous fertilizer and lime on leaf areas

Analysis of variance results (Table 14) indicated that significant interaction between rates of phosphorous fertilizer and lime application was found in leaf areas at R_2, R_4, R_6 and R_8 stages.

Table 14: Analysis of variance for leaf areas

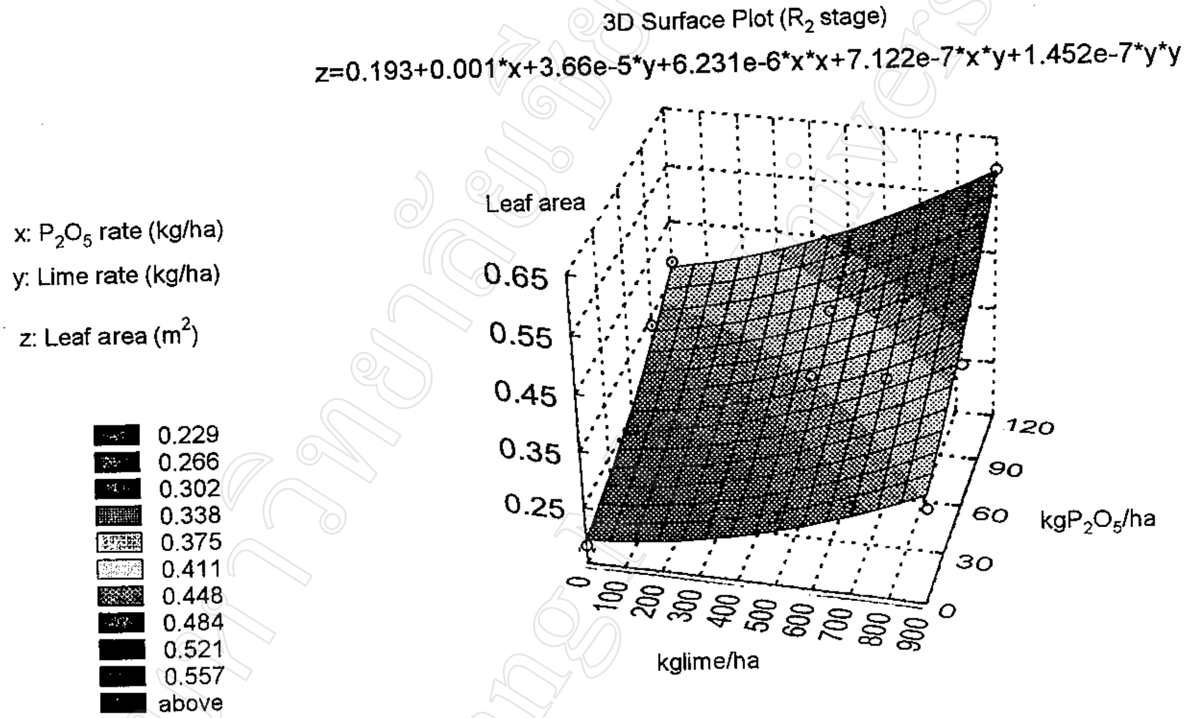
Source of variation	Significant level of growth stages			
	R_2	R_4	R_6	R_8
Replication	ns	ns	ns	ns
Lime (L)	* *	* *	* *	* *
Phosphorous (P)	* *	* *	* *	* *
P x L	* *	*	* *	**
CV (%)	26.92	14.59	18.83	18.63

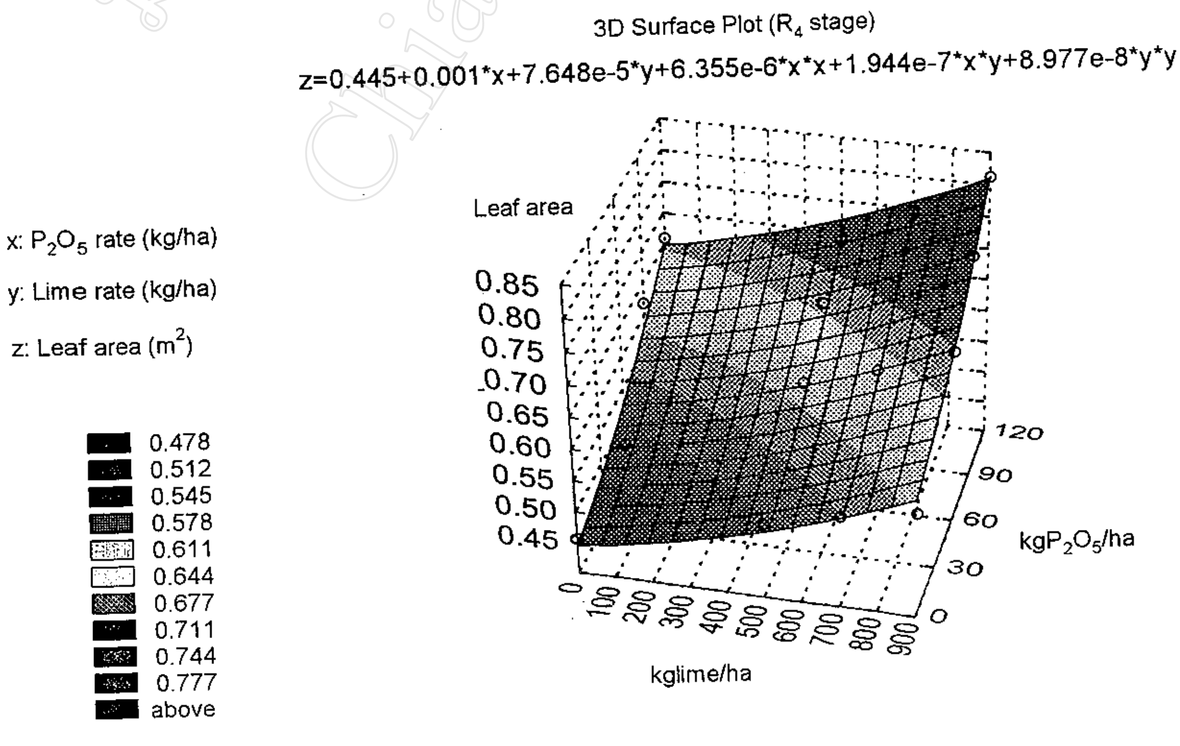
* indicates significant at 0.05% level

** indicates significant at 0.01% level

ns indicates not significant.

Figure 14 presents leaf areas responded to phosphorous fertilizer and lime application at R_2, R_4, R_6 and R_8 stages of peanut. Generally, leaf areas increased significantly as phosphorous and lime application rates increased. Liming at 700 and 900 kg ha^{-1} showed greater response in leaf areas to phosphorous fertilizer than those of 0 and 500 kg of lime ha^{-1} at all studied growth stages. Average leaf areas were 0.85, 0.95, 1.19 and 1.35 m^2 at rate of 900 kg of lime ha^{-1} applied together with 0, 60, 90 and 120 kg of P_2O_5 ha^{-1}, respectively at R_6 stage. Leaf areas was obtained maximum value at R_6 stage (80 DAS) at all rates of phosphorous and lime application. At R_6 stage the average maximum leaf area which was 1.35 m^2, was obtained at treatment where 900 kg of lime ha^{-1} applied together with 120 kg of P_2O_5 ha^{-1} application. At R_8 stage (harvest stage), leaf area declined as compared with R_6 stage at all rates of phosphorous fertilizer and lime application. The average maximum leaf area at R_8 stage was 1.22 m^2 which was also obtained at 900 kg of lime ha^{-1} applied together with 120 kg of P_2O_5 ha^{-1}.





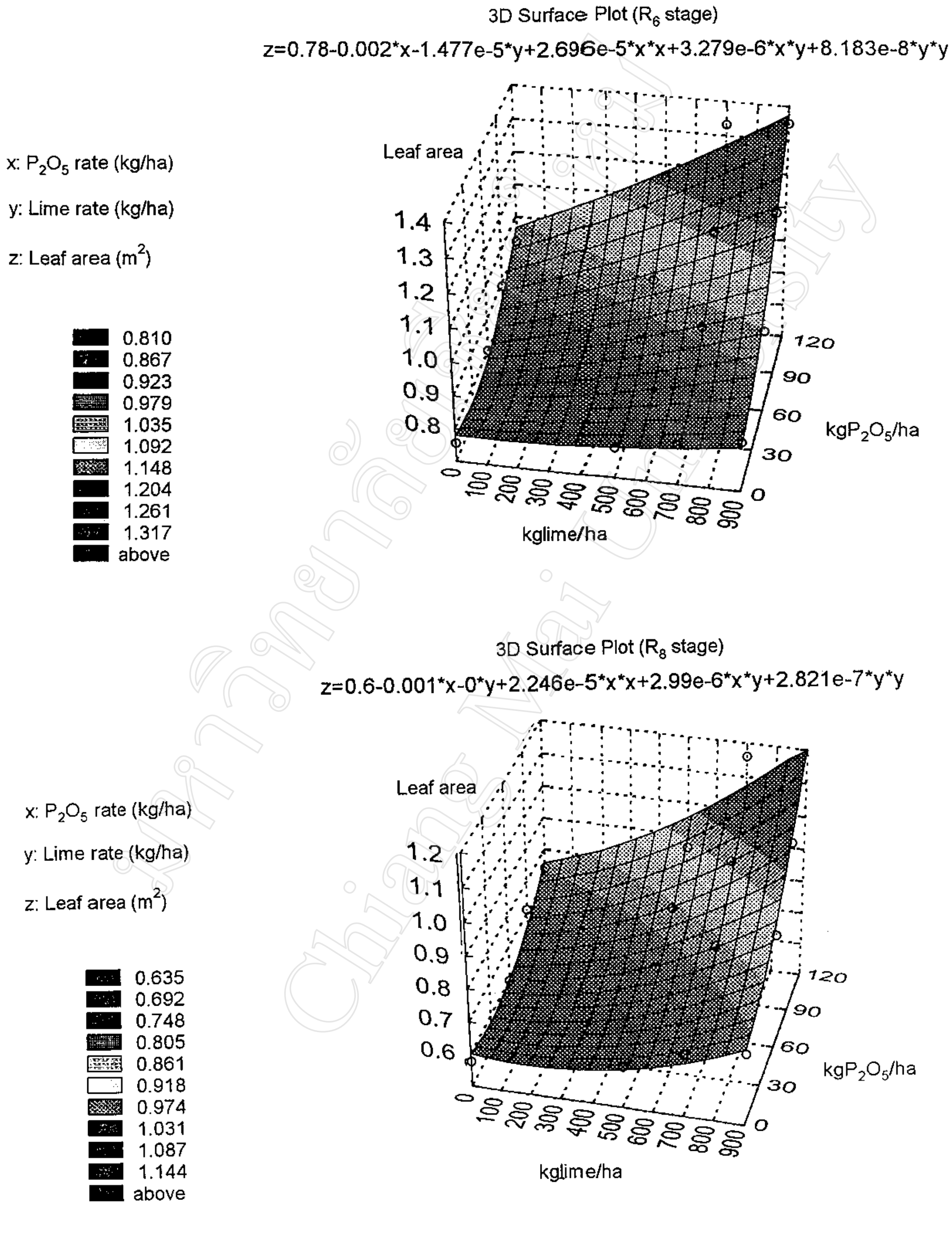


Figure 14: Effect of P fertilizer and lime on leaf area at R_2, R_4, R_6 and R_8 stages

5.5. Effect of phosphorous fertilizer and lime on pod yield and yield components of peanut

Significant interaction between phosphorous fertilizer and lime was found for number of pod per plant, number of filled pod per plant, number of unfilled pod per plant, pod weight, seed weight and pod yield of peanut.

Table 15: Analysis of variance for number of pod per plant, number of filled pod per plant, number of unfilled pod per plant, pod weight, seed weight and pod yield

Source of variation	Significant level of yield components and pod yield					
	No. of pod/plant	No. of filled pod/plant	No. of unfilled pod/plant	Pods weight	Seed weight	Pod yield
Replication	*	*	ns	ns	ns	ns
Lime (L)	**	**	**	* *	* *	* *
Phosphorous (P)	**	**	**	* *	* *	* *
P x L	*	**	**	**	* *	* *
CV (%)	18.02	26.25	23.99	4.08	4.06	22.14

* indicates significant at 0.05% level

** indicates significant at 0.01% level

ns indicates not significant.

5.5.1. Number of pod per plant

Analysis results (Table 15) showed that there was significant interaction between phosphorous fertilizer and lime application rates for number of pod per plant ($P<0.05$).

General speaking, increasing phosphorous fertilizer application rate increased number of pod per plant at all rates of lime application (Figure 15). On average, the highest number pod per plant was recorded at rate of 120 kg of P_2O_5 ha^{-1} applied together with 900 kg of lime ha^{-1} which was 21.7 pods. In contrast, the lowest number of pod per plant was observed at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} which was 10.2 pods. Besides, liming at 700 and 900 kg ha^{-1} showed greater response in number of pod per plant to phosphorous fertilizer than that of 0 and 500 kg ha^{-1}.

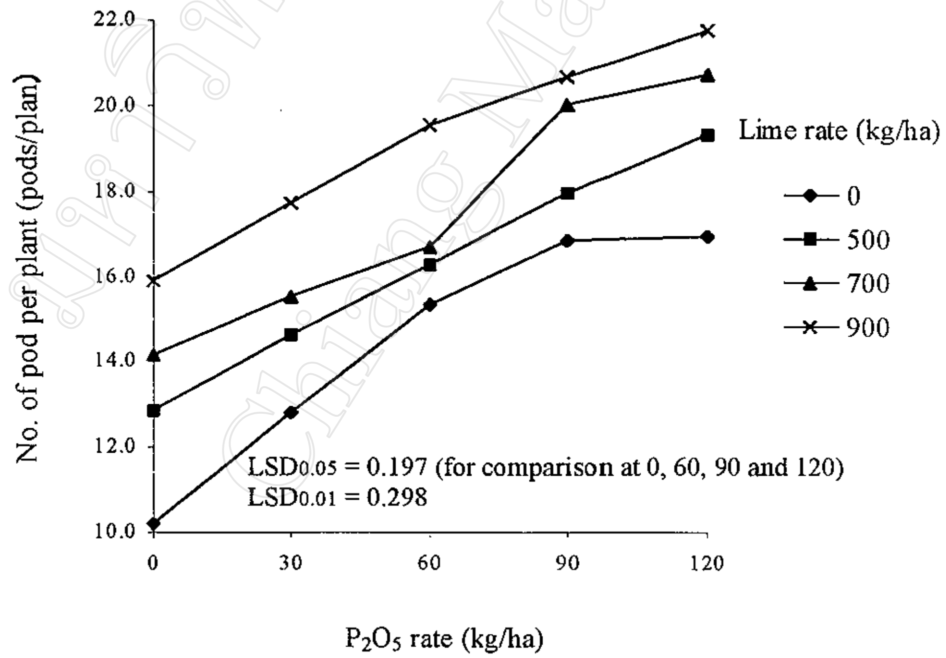


Figure 15: Effect of P fertilizer and lime on pod number of peanut

5.5.2. Number of filled pod per plant

Analysis result of number of filled pod per plant was similar to number of pod per plant. It was found that there was significant interaction between phosphorous fertilizer and lime application rates on number of filled pods per plant (Figure 16). The average number of filled pod per plant was 12.9, 16.9, 18.2 and 19.3 pods with respect to 0, 60, 90 and 120 kg P_2O_5 ha^{-1} when applied together with 900 kg lime ha^{-1}, respectively. Besides liming at 900 kg ha^{-1} showed the greatest response in number of filled pod per plant to phosphorous fertilizer then the remaining lime application rates.

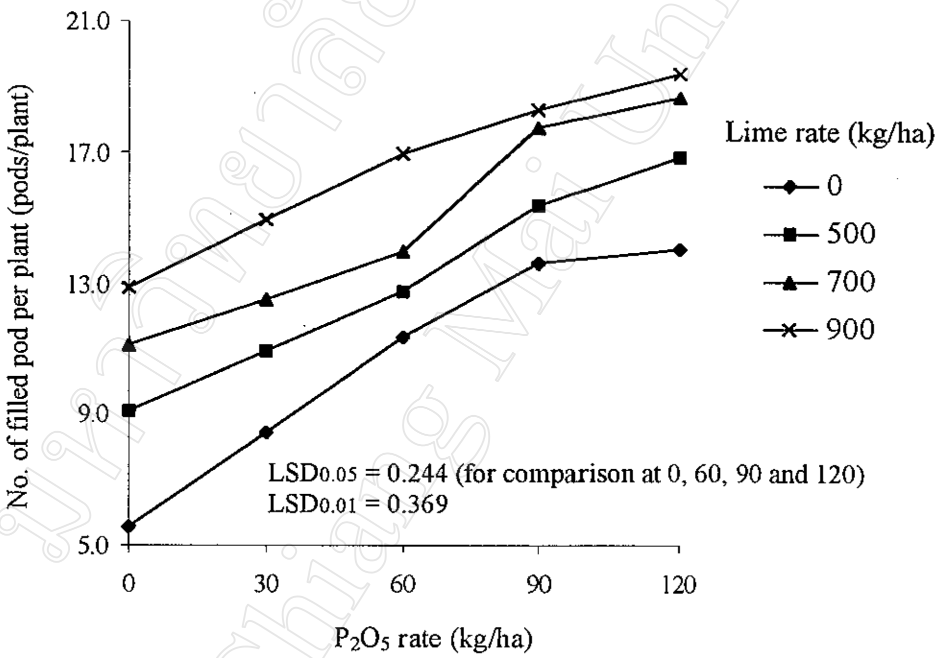


Figure 16: Effect of P fertilizer and lime on filled pod number of peanut

5.5.3. Number of unfilled pod per plant

It was found that an interaction effect between phosphorous fertilizer and lime on unfilled pod number was detected when phosphorous fertilizer and lime were combined. Application of phosphorous fertilizer together with lime trend to minimize number of unfilled pod per plant (Figure 17&18).

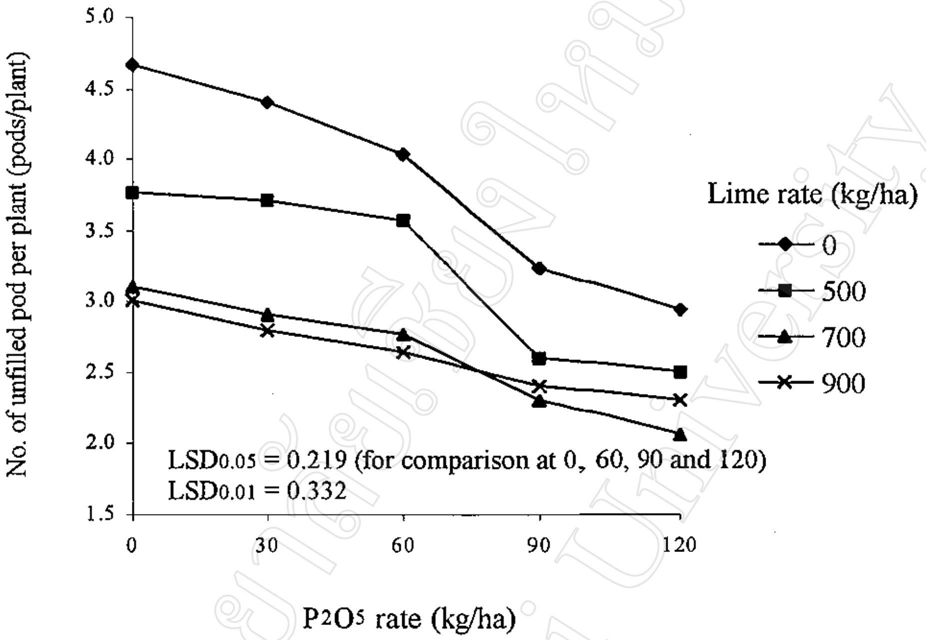


Figure 17: Effect of P fertilizer and lime on unfilled pod number of peanut

Generally, an increasing in phosphorous application rate decreased number of unfilled pod of peanut. However application of phosphorous fertilizer together with lime declined number of unfilled pod of peanut greater than treatment without lime. The most effective rate of phosphorous and lime was 120kg of P_2O_5 ha^{-1} and 700 kg of lime ha^{-1} which gave 55.7% decreased in number of unfilled pod as compared with number of unfilled pod at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} application (Figure 18). Besides, at 120 kg of P_2O_5 ha^{-1} and 700 kg of lime ha^{-1} number of unfilled pod per plant was 2.1 pods per plant as compared with 4.7 pods per plant at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} application.

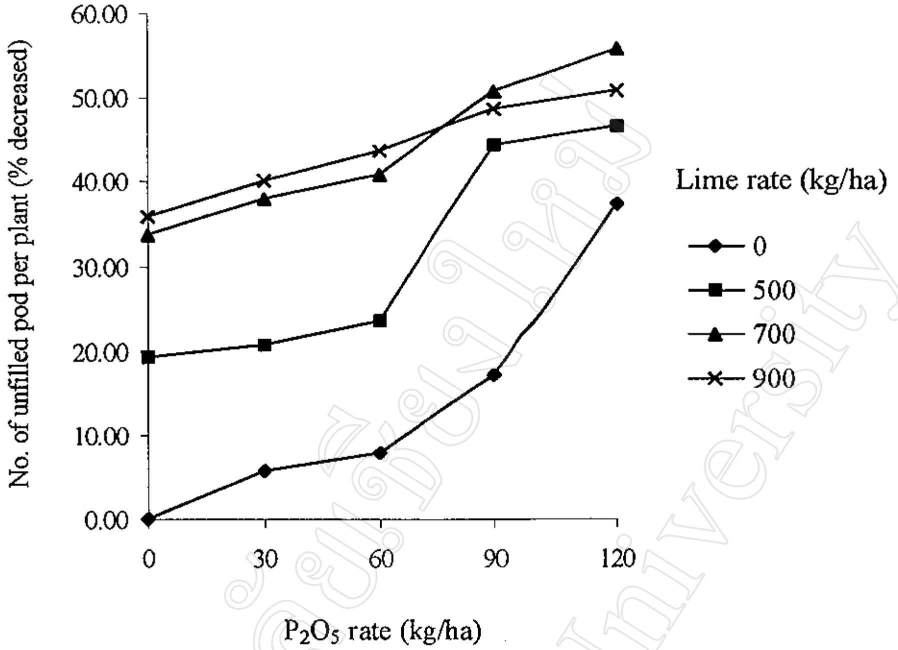


Figure 18: Effect of P fertilizer and lime on % decreasing of unfilled pod number of peanut

5.5.4. 100 - pod weight

Analysis of variance results (Table 15) also showed that significant interaction between phosphorous fertilizer and lime application rates ($P<0.01$) was found for 100 - pod weight. Average pod weight of peanut of application rates including 0, 500, 700 and 900 kg of lime ha^{-1} in combination with 90 kg of P_2O_5 ha^{-1} was 85.7, 87.5, 89.3, and 89.9, respectively. On the average the highest 100 - pod weight was 90.8 mg at rates of 120 kg of P_2O_5 ha^{-1} together with 900 kg of lime ha^{-1} application. The lowest value was obtained at 0 kg of P_2O_5 ha^{-1} in combined with 0 kg of lime ha^{-1} application which was 80.5 mg (Figure 19). Liming at 900 kg ha^{-1} showed greatest response in 100 – seed weight to phosphorous fertilizer than those of the remaining rates of lime application.

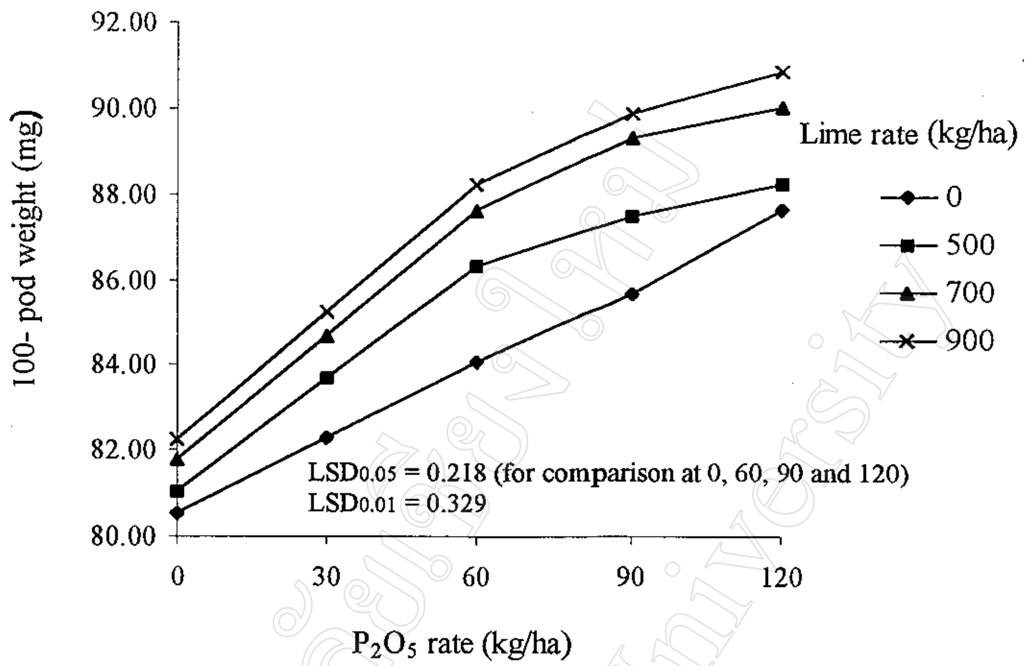


Figure 19: Effect of P fertilizer and lime on 100 - pod weight

5.5.5. 100 -seed weight

Similar to 100 - pod weight, there was significant interaction between phosphorous fertilizer and lime application on 100 - seed weight of peanut. In general, there was a trend of increasing 100 - seed weight as phosphorous fertilizer and lime application rates increased. On the average the maximum 100 - seed weight was observed at the rate of 120 kg P_2O_5 ha^{-1} which corresponded to 0, 500, 700 and 900 kg lime ha^{-1} application together of 38.6, 39.7, 40.5, 41.0 mg, respectively. Whereas without phosphorous fertilizer and lime application, 100 - seed weight was only 36.7 mg (Figure 20). Liming at 900 kg ha^{-1} also showed the greatest response in 100 - seed weight to phosphorous fertilizer than those of 0, 500 and 700 kg ha^{-1} application.

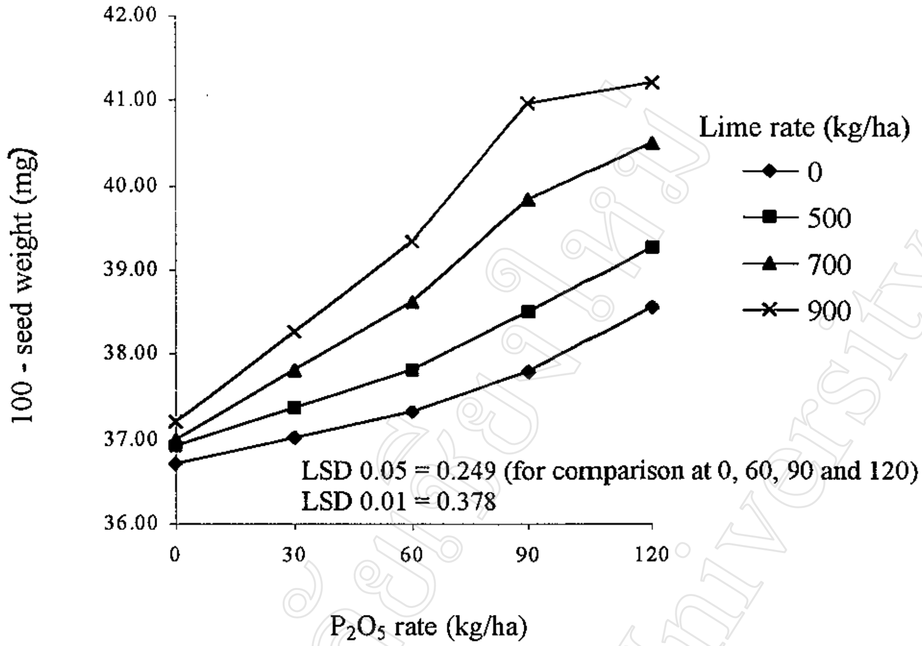


Figure 20: Effect of P fertilizer and lime on seed weight

5.5.6. Pod yield of peanut

Analysis results (Table 15) indicated that there was significant interaction between effects of phosphorous fertilizer and lime on peanut pod yield ($P<0.01$). It was also found that there was significant difference between phosphorous fertilizer and lime application.

Generally, an increasing in phosphorous application rate increased pod yield of peanut. However application of phosphorous fertilizer together with lime enhanced pod yield of peanut greater than treatment without lime. The most effective rate of phosphorous and lime was 120 kg of P_2O_5 ha^{-1} and 900 kg of lime ha^{-1} which gave 101% increased in pod yield of peanut as compared with pod yield at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} application (Figure 22). Besides, at 120 kg of P_2O_5 ha^{-1} and 900 kg of lime ha^{-1} pod yield was 2,189 kg as compared with 1,086 kg pods at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} application.

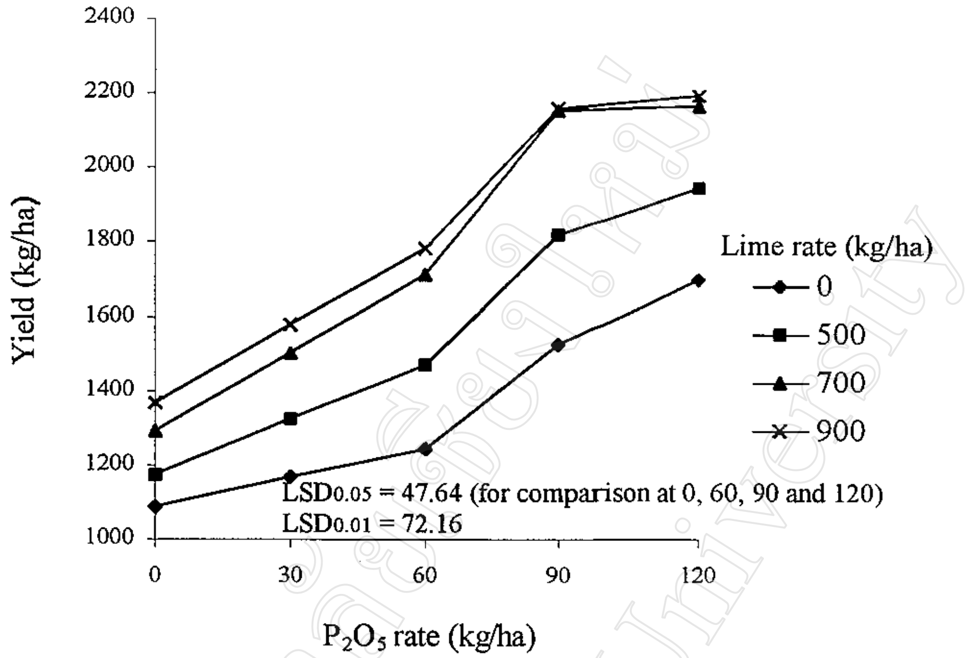


Figure 21: Effect of P fertilizer and lime on pod yield

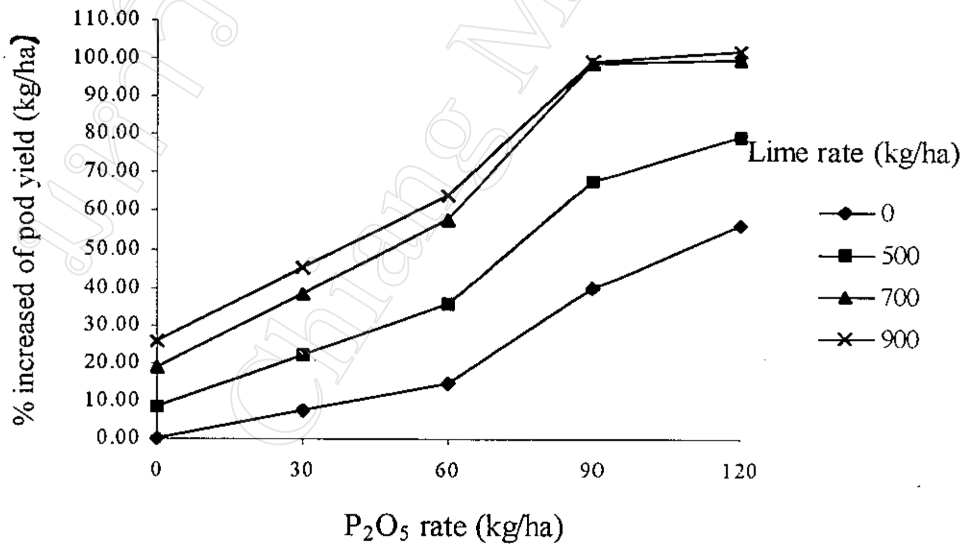


Figure 22: Effect of P fertilizer and lime on % increasing of pod yield

5.6. Effect of phosphorous fertilizer and lime on N, P and K concentration in plant

Analysis variance results (Table 16) showed that there was significant different between phosphorous fertilizer and lime on N, P and K concentration in plant.

Table 16: Summary of analysis of variance for N, P, and K concentration in plant

Source of variation	Significant level		
	N	P	K
Replication	ns	ns	ns
Lime (L)	* *	* *	*
Phosphorous (P)	* *	* *	* *
P x V	ns	ns	ns
CV (%)	12.01	14.06	8.93

* indicates significant at 0.05% level,

** indicates significant at 0.01% level,

ns indicates not significant.

5.6. 1. Effect of phosphorous fertilizer and lime on N concentration in plant

Analysis result in Table 16 showed that there was no significant interaction between phosphorous fertilizer and lime application on nitrogen concentration. It was found that an increasing in phosphorous fertilizer application rate also increase nitrogen concentration in plant (Figure 23). The N concentration was 2.89, 3.18, 3.33, and 3.51% as the results of application of 60, 90, 120 kg P_2O_5 ha^{-1} alone, respectively.

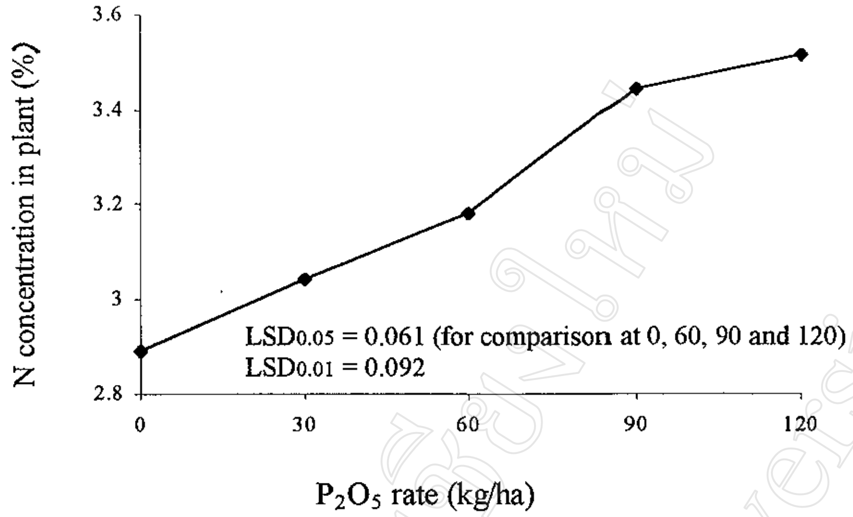


Figure 23: Effect of P fertilizer on N concentration in plant

However, response of nitrogen concentration in plant to lime was smaller than those of phosphorous application. N concentration in plant when liming at 500, 700 and 900 kg lime ha^{-1} was 3.14, 3.34, 3.35 and 3.40 %, respectively.

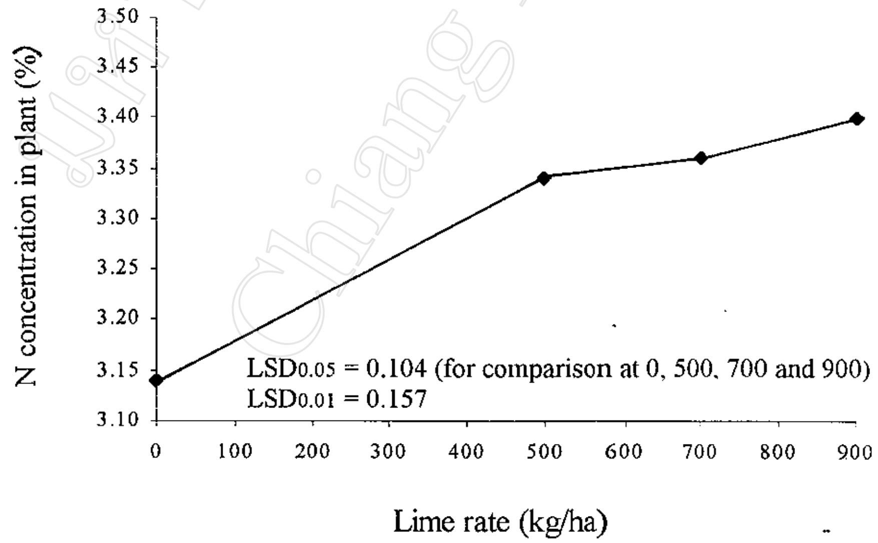


Figure 24: Effect of lime on nitrogen concentration

5.6.2. Effect of phosphorous fertilizer and lime on P concentration in plant

There was no significant interaction (P>0.05) on phosphorous fertilizer concentration between phosphorous fertilizer and lime application rates as shown in Table 16.

Similar to nitrogen concentration, an increasing in phosphorous fertilizer rate also increased P concentration in plant. Applying phosphorous fertilizer increased P concentration in plant by 14.3, 25.0 and 28.6% with respect to 60, 90 and 120 kg P_2O_5 ha^{-1} (Figure 25). P concentration in plant when liming at 0, 500, 700 and 900 kg lime ha^{-1} was 0.28, 0.32, 0.34 and 0.36%, respectively (Figure 26).

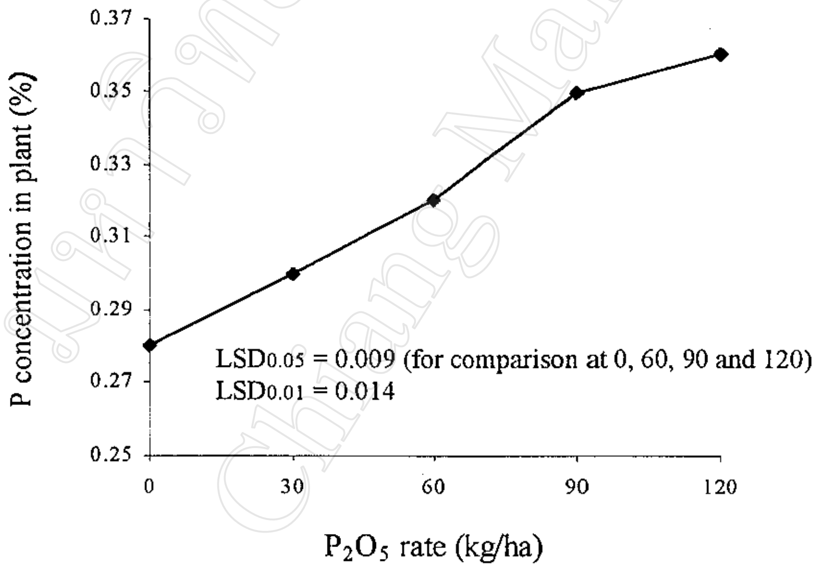


Figure 25: Effect of P fertilizer on P concentration in plant

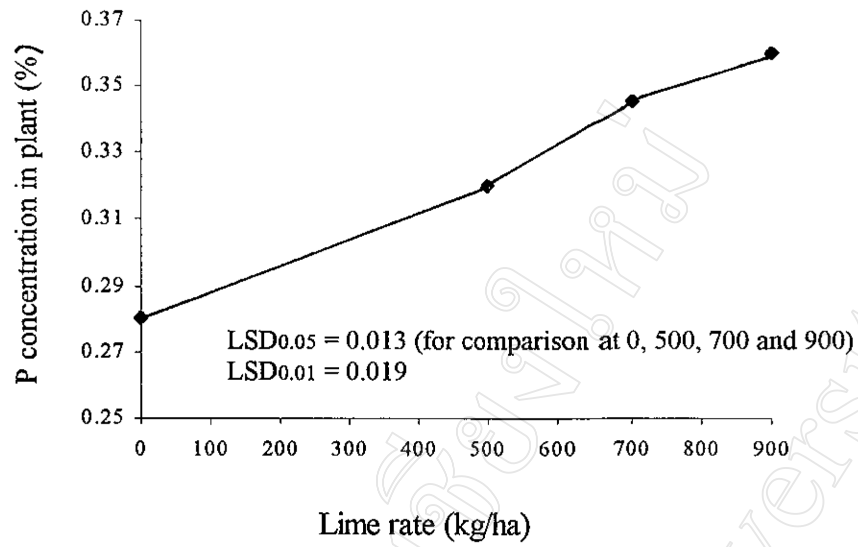


Figure 26: Effect of lime on P concentration in plant

5.6.3. Effect of phosphorous fertilizer and lime on K concentration in plant

Analysis results from Table 16 showed that there was significant difference on K concentration in plant as lime and phosphorous fertilizer application rates increased. Analysis of variance results also indicated that no significant interaction was found on K concentration between phosphorous fertilizer and lime application rates.

In case of K concentration in plant, an increasing in phosphorous fertilizer application rates also increased K concentration in plant. The highest K concentration was found at rate of 120 kg of P_2O_5 ha^{-1} application which was 1.5% and the lowest K concentration was 1.3% at rate of 0 kg of P_2O_5 ha^{-1} (Figure 27). However, response of K concentration in plant to lime was smaller than those of phosphorous fertilizer application. The average K concentration was 1.4, 1.4, 1.5 and 1.5% with respect to 0, 500, 700 and 900 kg of lime ha^{-1} (Figure 28).

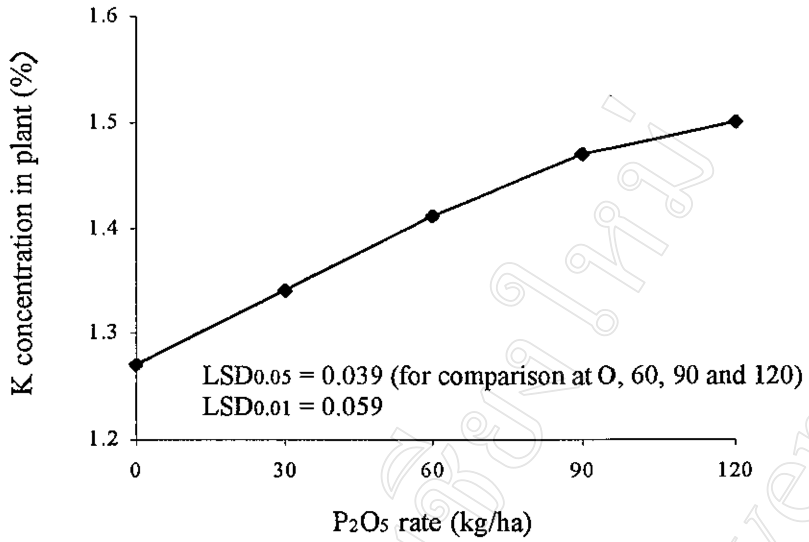


Figure 27: Effect of P fertilizer on K concentration in plant

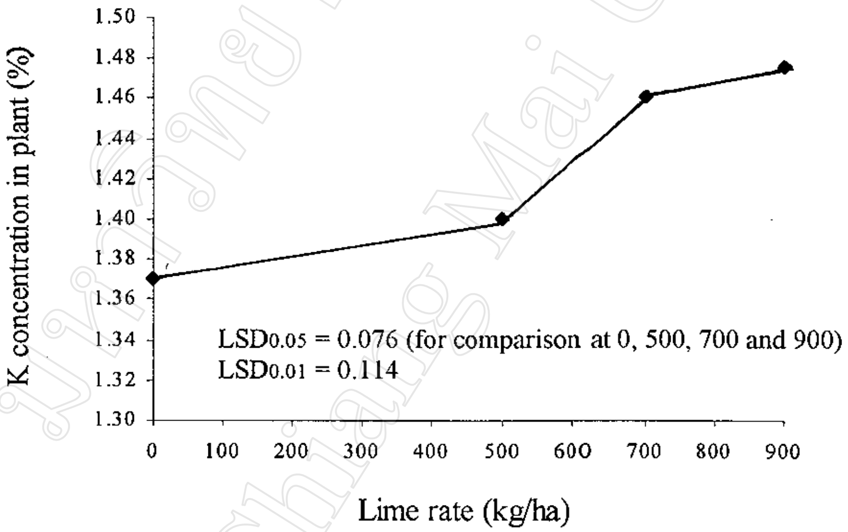


Figure 28: Effect of lime on K concentration in plant

5.7. Effect of phosphorous fertilizer and lime on soil nutrient

Analysis variance results in Table 17 indicated that there was significant interaction on pH, organic matter and available phosphorous between different rates of phosphorous fertilizer and lime application.

Table 17: Analysis of variance for soil properties after field experiment

Source of variation	F test					
	pH	OM	N	P_2O_5	K_2O	Avai.P
Replication	ns	*	*	**	ns	ns
Lime (L)	* *	*	* *	* *	ns	* *
Phosphorous (P)	* *	* *	* *	* *	* *	* *
P x V	*	* *	ns	ns	ns	* *
CV (%)	9.31	21.59	12.29	20.48	18.46	22.53

* indicates significant at 0.05% level

* * indicates significant at 0.01% level

ns indicates not significant.

Figure 29 demonstrated response of available soil phosphorous to an increasing rate of phosphorous fertilizer and lime application. The available phosphorous in soil was increased much greater when phosphorous fertilizer and lime together applied than separately applied. On the average, the maximum available phosphorous in soil was 10.06mg/100g soil which was corresponded to 120 kg P_2O_5 ha^{-1} together with 900 kg lime ha^{-1}.

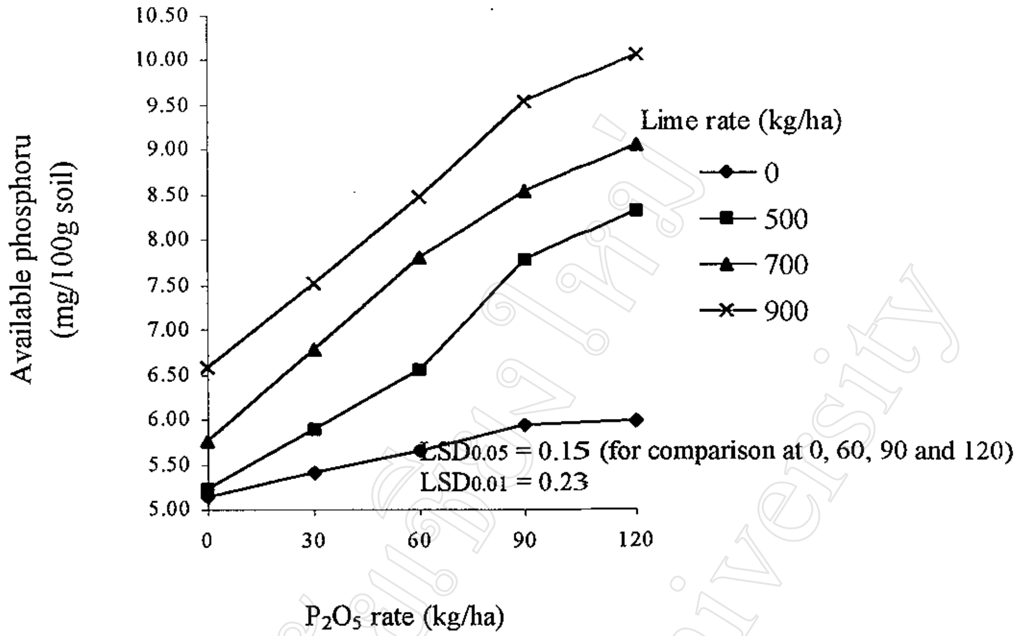


Figure 29: Effect of P fertilizer and lime on available phosphorous

Similar to available phosphorous, pH and organic matter also was affected by the effects of phosphorous fertilizer and lime application (Figure 30 and 31). An increasing in phosphorous fertilizer application rate increased both soil pH and % organic matter. Besides, lime application together with phosphorous fertilizer further enhanced pH and % organic matter. On the average, the maximum pH was 5.9 and % organic matter was 1.82 which was corresponded to 120 kg P_2O_5 ha^{-1} together with 900 kg lime ha^{-1}.

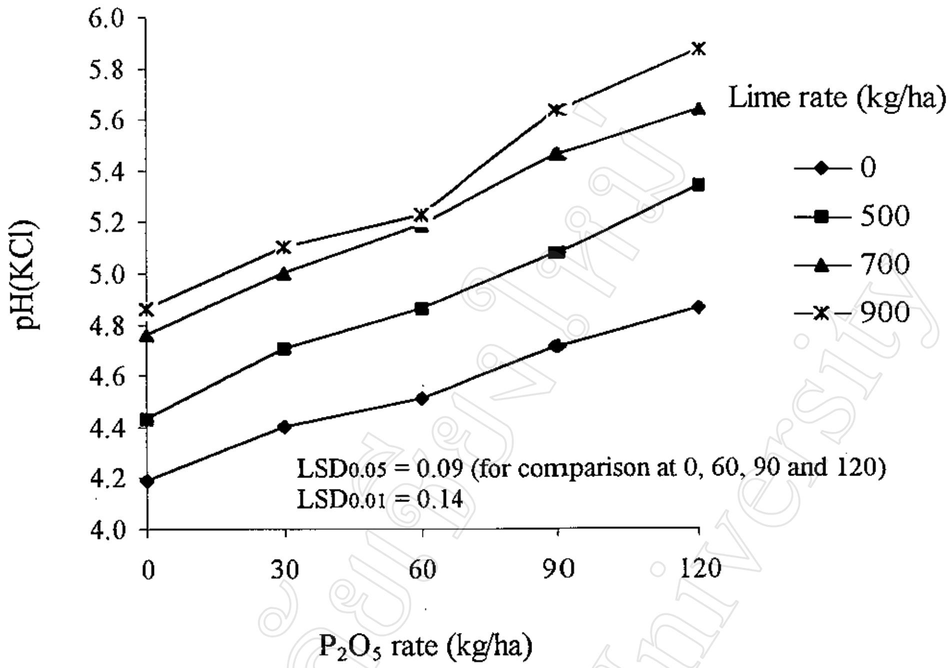


Figure 30: Effect of P fertilizer and lime on pH_{KCl}

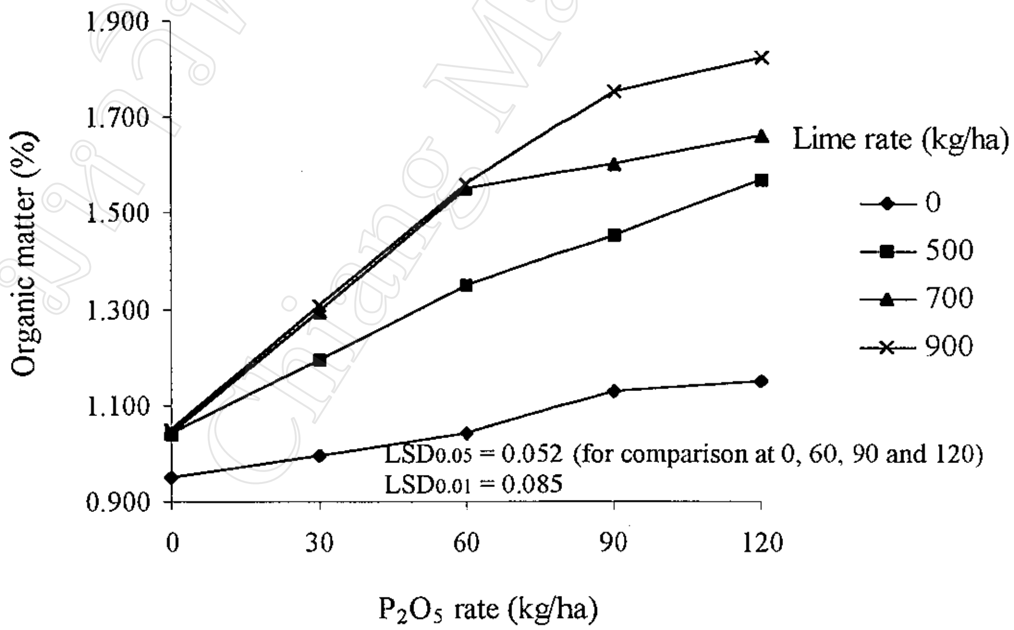


Figure 31: Effect of P fertilizer and lime on organic matter

Total N and P_2O_5 increased significantly as phosphorous fertilizer and lime application separately increased. Liming up to 500, 700 and 900 kg ha^{-1} increased total N and P_2O_5 by 106, 110, 117 and 120, 130, 140%, respectively (Figure 32). The highest total nitrogen and phosphorous was 0.06 and 0.04 % respectively at rate of 120 kg of P_2O_5 ha^{-1}. And the lowest values were 0.04 and 0,03% respectively at rate of 0 kg of P_2O_5 ha^{-1} (Figure 33).

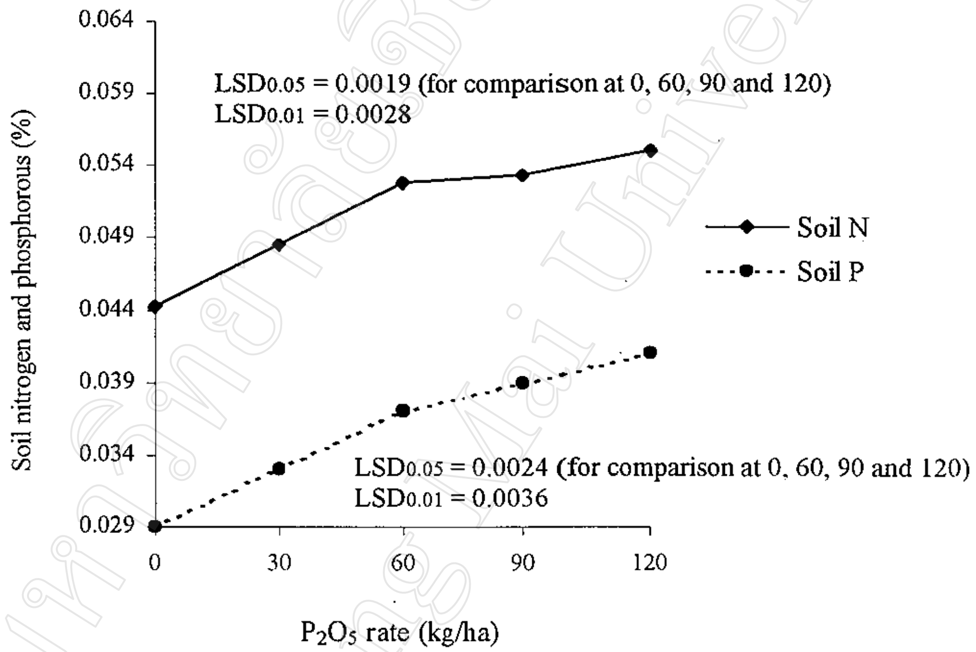


Figure 32: Effect of P fertilizer on total nitrogen and phosphorous

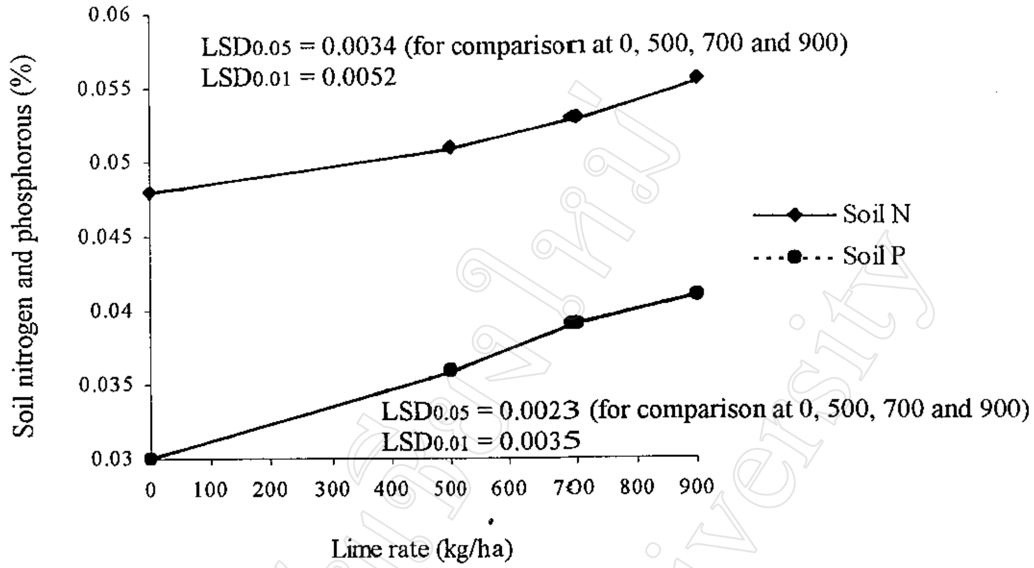


Figure 33: Effect of lime on total soil nitrogen and phosphorous

Similarly, total K only increased significantly as phosphorous fertilizer application increased. The average total K was 0.21, 0.25, 0.27 and 0.28% corresponding to 0, 60, 90 and 120 kg P_2O_5 ha^{-1}, respectively (Figure 34).

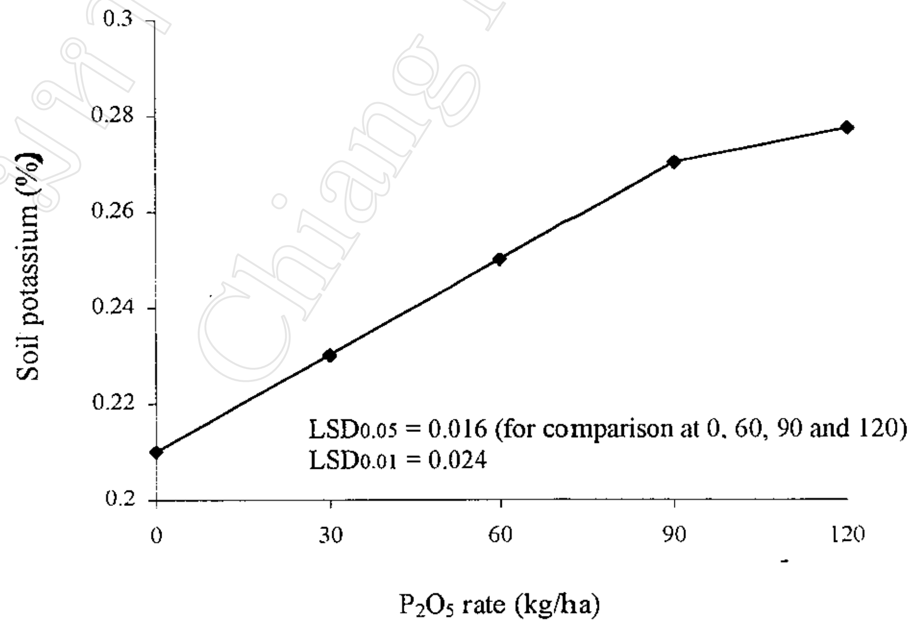


Figure 34: Effect of P fertilizer on total soil potassium

5.8. Economic consideration

Table 18: Economic consideration for different treatments (Thousand VND ha^{-1}).

Fertilizers (kg/ha)		Yield (kg/ha)	TR (1)	VC (2)	GM (3)	Increased GM (4)	Increased cost of P&Lime (5)	VCR of P&L (6)
Lime	P		1000 VND ha^{-1}					
0	0	1,086^{abc}	5,971	3,547	2,424	0	0	0
500	0	1,425^{abcd}	6,463	3,759	2,704	280	212	1.3
700	0	1,552^{abcd}	7,497	3,839	3,658	1,234	292	4.2
900	0	1,677^{abcd}	7,515	3,919	3,596	1,172	372	3.2
0	60	1,175^{abcd}	7,835	4,111	3,724	1,300	564	2.3
500	60	1,470^{abcd}	8,085	4,323	3,762	1,338	776	1.7
700	60	1,867^{ab}	9,409	4,415	4,944	2,570	868	3.0
900	60	1,943^{cd}	9,799	4,495	5,304	2,880	948	3.0
0	90	1,363^{bcd}	8,537	4,363	4,174	1,750	816	2.1
500	90	1,711^{d}	10,267	4,587	5,680	3,256	1,040	3.1
700	90	2,154^{abc}	11,847	4,717	7,130	4,706	1,170	4.0
900	90	2,166^{a}	11,853	4,759	7,094	4,670	1,212	3.9
0	120	1,366^{abcd}	9,226	4,615	4,611	2,187	1,068	2.0
500	120	1,782^{abc}	10,685	4,827	5,858	3,434	1,280	2.7
700	120	2,155^{abc}	11,911	4,919	6,992	4,568	1,372	3.3
900	120	2,189^{abcd}	12,041	4,999	7,042	4,618	1,452	3.2

(1) Total revenue (TR) = Pod yield x Price of 1kg of peanut.

(2) Variable cost (VC) = Labor cost + Land preparation (Plough machine) + Seed cost + Fertilizer cost + Pesticide cost

(3) Gross margin (GM) = TR - VC

(4) Increased gross margin as compared with control treatment (Without P and lime application)

(5) Increased costs of P and Lime as compared with control treatment.

(6) VCR (Value cost ratio) of phosphorous fertilizer and lime = Increased Gross Margin / Increased costs of P and lime

(7) VND = Vietnamese dong, 1US$ = 14,000 VND

In fact, all treatments applied phosphorous fertilizer and lime gave higher total revenue and gross margin than without phosphorous fertilizer and lime application (Table 18). The highest total revenue was observed at rates of 120 kg of P_2O_5 ha^{-1} together with 900 kg of lime ha^{-1} which was 12.04 million VND, however the highest gross margin was found at rates of 90 kg of P_2O_5 ha^{-1} together with 700 kg of lime ha^{-1} which was 7.13 million VND. In addition, the most effective rate of phosphorous and lime was 90 kg of P_2O_5 ha^{-1} and 700 kg of lime ha^{-1} which gave 203% increased in gross margin as compared with gross margin at 0 kg of P_2O_5 ha^{-1} and 0 kg of lime ha^{-1} application (Figure 35). While application of 120 kg of P_2O_5 ha^{-1} and 900 kg of lime ha^{-1} which gave only 193% increased in gross margin as compared with gross margin at control treatment. Therefore, there is decrease in gross margin when peanut is invested more phosphorous and lime. The lowest total revenue and gross margin of 5.97 million and 2.42 million VND respectively were obtained in the control where there was no phosphorous fertilizer and lime application.

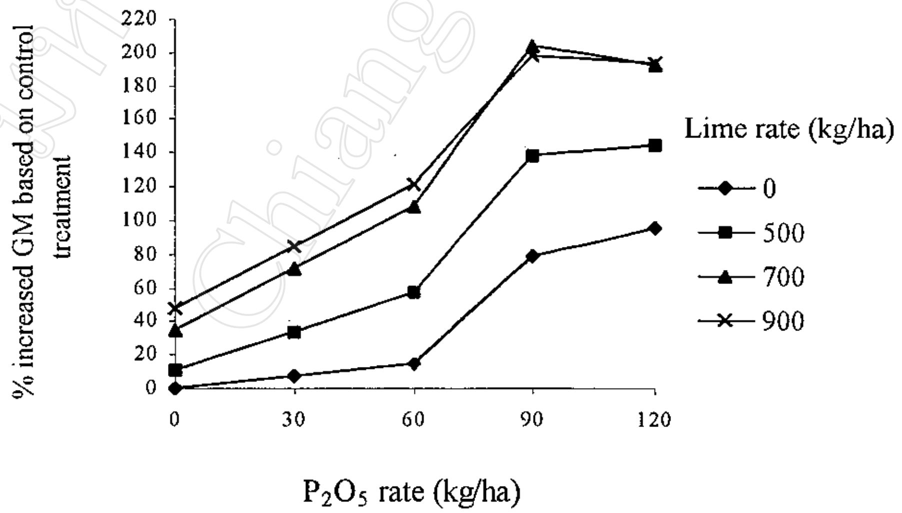


Figure 35: Effect of P fertilizer and lime on % increased gross margin

In terms of economic efficiency of phosphorous fertilizer and lime application for peanut, results from Table 18 also indicated that treatments where there was the presence of phosphorous fertilizer and lime had greater VCR than without phosphorous fertilizer and lime application. The highest VCR value was obtained at treatment which 700 kg of lime ha^{-1} applied alone was 4.2. However, phosphorous application gave much lower VCR value than liming alone while it increased gross margin more than lime to 4.61 millionVND at 120 kg P_2O_5 ha^{-1}. Application phosphorous together with lime also gave high VCR value which was 4.0 at treatment where 90 kg of P_2O_5 ha^{-1} and 700 kg of lime applied together. In general, crop production has benefit when VCR value is higher than 2. Research results from Table 18 also showed that almost of treatments had VCR over 2. It means that application lime and phosphorous can give profit for peanut growers.