The Pharma Innovation Journal 2022; SP-11(6): 1231-1234

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(6): 1231-1234

www.thepharmajournal.com
Received: 01-03-2022
Accepted: 05-04-2022

Ajay Kumar Shah
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Dr. R Bajpai
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Dr. RB Singh
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Dr. MK Awasthi
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Dr. PS Kulhade
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Corresponding Author
Ajay Kumar Shah
Department of Forestry, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

Nutrient uptake of mustard crop in different fertilizer levels under *Gmelina arborea* and *Dalbergia sissoo* based agroforestry systems

Ajay Kumar Shah, Dr. R Bajpai, Dr. RB Singh, Dr. MK Awasthi and Dr. PS Kulhade

Abstract
A field experiment was conducted at research farm, department of forestry, JNKVV, Jabalpur during rabi season 2020-21 to find out nutrient uptake of mustard crop in different fertilizer levels under *Gmelina arborea* and *Dalbergia sissoo* based agroforestry systems. The experiment was laid out in a factorial randomized block design (FRBD) with 4 replications and 2 factor and 3 fertilizer treatments consisted of F_1 (75%NPK@ 45:30:30 kg ha^{-1}), F_2 (100%NPK@ 60:40:40 kg ha^{-1}), and F_3 (125%NPK@ 75:50:50 kg ha^{-1}) the nutrient absorption by mustard crop under different fertilizer levels. The result revealed that there were different variations in nutrients uptake by mustard. The highest nutrient absorption by mustard seed was observed in F_3 (9.20:0.858:8.91) and minimum was in F_1 (5.16:0.352:3.97). The highest nutrient absorption by straw was observed in F_3 (4.64:0.122:24.49) and minimum was in F_1 (3.07:0.084:19.36). among different factor under fertilizer level was different estimated in mustard grain under Gmelina was estimated maximum was found in F_3 (11.34:1.133:10.33) and minimum was in F_1 (6.01:0.513:4.56) whereas under fertilizer level was different estimated in mustard straw under Gmelina was estimated maximum was found in F_3 (4.99:0.130:24.09) and minimum was in F_1 (3.52:0.096:20.69) moreover mustard grain under Dalbergia was estimated maximum was found in F_3 (7.06:0.583:7.49) and minimum was in F_1 (4.30:0.191:3.39) whereas under fertilizer level was different estimated in mustard straw under Gmelina was estimated maximum was found in F_3 (4.29:0.113:18.03) and minimum was in F_1 (2.65:0.072:24.90).

Keywords: Mustard crop, *Gmelina arborea*, *Dalbergia sissoo*

Introduction
Agroforestry is based on the premise that land-use systems that are structurally and functionally more complex than either crop or tree monocultures result in greater efficiency of resource (nutrients, light, and water) capture and utilization, and greater structural diversity that entails tighter nutrient cycles. While the above- and belowground diversity provides more system stability and resilience at site level, the systems provide connectivity with forests and other landscape features at landscape and watershed levels (Nair *et al.*, 2008) [1] Active management practices of tree and crop root distribution can reduce belowground competition at the tree-crop interface Nutrient acquisition in the horizontal dimension is strongly controlled by the spatial arrangement of trees and crops, trees have some potential to reduce some productivity of crop then it have to compensate with application of fertilizer they have to improve productivity of crops like mustard, wheat and other crops. this has to made mustard growing under cropping system with agroforestry it have to possible to fulfill of oil consumption in India

Mustard is the second most important oil seed crop, contributing nearly 25-30% of the total oil seed production in the country. Optimum nutrition is required for getting maximum seed yield and good quality of the grain. Several abiotic and biotic factors have been found to effect mustard yields apart from major plant nutrients (N, P and K) and other nutrients play an important role in the production phenology of oil seed crops and these crops respond well to applied some nutrients (Karthi Keyan and Shukla 2008) [5].

Material and Methods
The field experiment was conducted during the winter (rabi) seasons of 2019-20 at College of Agriculture, Jabalpur, JNKVV, (MP) The soil was sandy loam, slightly acidic in nature to find out the productivity of mustard crops under Agroforestry systems.

The experiment was laid out in a Factorial Randomized Complete Block Design (RCBD) with 4 replications and 3 fertilizer level with 2 factor (systems) treatments consisted F_1 (75%NPK@ 45:30:30 kg ha^{-1}), F_2 (100%NPK@ 60:40:40 kg ha^{-1}), and F_2 (125%NPK@ 75:50:50 kg ha^{-1}).The soil of the experimental field was silty clay loam in texture, low and high rating for available nitrogen (293.63 and 354.17 kg N ha^{-1}), phosphorus (2.85 and 9.06 kg P_2O_5 ha^{-1}) and potassium (250.5 and 328.73 kg K_2O ha^{-1}) under *Gmelina arborea* and *Dalbergia sissoo* respectively. The soil was found slightly acidic (pH 6.5) in reaction. Mustard variety (Pusa Tarak) was sown on 20 to 24th October, 2020-21 at row spacing of 30 cm by using 5 kg ha^{-1} seed rate. All the quantity of NPK was applied at the time of provide as basal application. Plant protection done for controlling of Aphid (saw fly) in the mustard crop, lethal gold (Bifenthrin 3% + Chlorphyriphos 30% EC) at 2 ml per liter of water was sprayed during flowering period.

Estimation of N, P and K uptake by mustard crop

To estimate the uptake of N, P and K, samples were collected at harvest for mustard crop. The samples were oven dried at 65^{0}C temperature. Nitrogen uptake by mustard crop was determined by digesting the plant samples with suitable acid mixture of concentrated sulphuric acid. Phosphorus was estimated by Vanedomolybdate method in diacid mixture. The intensity of the colour developed was measured in a spectrophotometer, using blue filter. Potassium content was estimated from diacid digest material using Flame Photometer and was expressed as percentage K. The nutrient content and dry weight were used to calculate the total uptake of nutrients (NPK) as per the following formula.

$$\text{Nutrient uptake (kg ha-1)} = \frac{\text{Nutrient content (\%) X Dry weight (kg ha}^{-1}\text{)}}{100}$$

Results and Discussion

The N, P, K, content percentage (%) (Table 1) revealed that varies under different treatments with different systems of agroforestry that was estimated in N content % was under grain and straw varies 2.03 to 2.59 and 0.22 to 0.26 that was found maximum in F_3 under gmelina system grain and straw N content varies 2.43 and 0.25 whereas dalbergia system 2.15 and 0.22 however P content % was under grain and straw varies 0.13 to 0.24 and 0.0059 to 0.0068 that was found maximum in F_3 under gmelina system grain and straw P content varies 0.22 and 0.0069 whereas dalbergia system 0.14 and 0.0058 moreover K content was under grain and straw varies 1.6 to 2.6 and 3.86 to 6.42 that was found maximum in F_3 whereas gmelina system grain and straw K content varies 2.2 and 5.12 whereas dalbergia system 2.0 and 4.97.

Table 2. shown that the N, P, K, uptake was variation varies to system as well as application of fertilizer levels they are explained one by one firstly N uptake (kg ha^{-1}) in grain due to fertilizer levels varies from 5.16 to 9.20 kg ha^{-1} whereas F_3 and F_2 were significant to F_1 however F_2 was at par with F_3 fertilizer levels however the maximum N uptake has been found as F_3, The mean N uptake of gmelina and dalbergia varies from 5..97 to 8.81 kg ha^{-1} whereas gmelina was significant superior dalbergia. The interaction effect of gmelina and dalbergia at F_1 was constant mean varies from 4.30 to 6.01 however Dalbergia was at par with Gmelina and F_2 was constant the mean value 6.56 to 9.08 whereas the gmelina was significant superior dalbergia. When F_3 was constant mean values varies from 7.06 to 11.34 kg ha^{-1} whereas the gmelina was significant superior dalbergia thus interaction effect at fertilizer level all treatment trend found significant While for the gmelina is constant means N absorption varies 6.01 to 11.34 kg ha^{-1} whereas all treatment were significant however F_3 and F_2 were significant to F_1 however F_3 was significantly superior to F_3 thus increase the fertilizer dose the N uptake into gmelina. While dalbergia N uptake varies from 4.30 to 7.06 kg ha^{-1} whereas F_3 and F_2 were significant to F_1 however F_2 was at par with F_3 the fertilizer levels. N uptake (kg ha^{-1}) in straw due to fertilizer dose varies from 3.08 to 4.64 kg ha^{-1} whereas F_3 were significant to F_1 and F_2 however F_1 was at par with F_2 fertilizer dose however the maximum N uptake has been found as F_3 and minimum was estimated on F_1 fertilizer dose. The mean N uptake of gmelina and dalbergia varies from 3.52 to 4.04 kg ha^{-1} whereas dalbergia was at par with gmelina The interaction effect of gmelina and dalbergia at F_1 is constant mean varies from 2.65 to 3.52 kg ha^{-1} however dalbergia was at par with gmelina and F_2 is constant the mean value 3.60 to 3.61 kg ha^{-1} whereas the gmelina was at par with dalbergia. When F_3 was constant mean values varies from 4.29 to 4.99 kg ha^{-1} whereas the gmelina was at par with dalbergia thus interaction effect at fertilizer level all treatment trend found significant with Dalbergia over to Gmelina While for the Gmelina is constant means N uptake varies 3.52 to 4.99 kg ha^{-1} whereas all treatment were significant however F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 thus increase the fertilizer dose the N uptake into *Gmelina*. While Dalbergia N uptake varies from 2.65 to 4.29 whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 fertilizer levels N uptake. Similar result reported by (Keerthi *et al.*, 2017) [6]. The nutrient status of plant tissue being the genetic character was affected less by the environment but, higher growth require higher uptake (Reager et al., 2006) [7].

P uptake in mustard grain due to fertilizer dose varies from 0.352 to 0.858 kg ha^{-1} whereas all treatments were significant to each other fertilizer dose at however the maximum P uptake has been found as F_3 and minimum was estimated on F_1 fertilizer dose. The mean P uptake of gmelina and dalbergia varies from 0.383 to 0.813 kg ha^{-1} whereas gmelina was significant to dalbergia The interaction effect of gmelina and dalbergia at F_1 was constant mean varies from 0.559 to 0.513 kg ha^{-1} however gmelina was significant to dalbergia and F_2 was constant the mean value 0.376 to 0.792 kg ha^{-1} whereas the gmelina was significant superior dalbergia. When F_3 was constant mean values varies from 0.582 to 1.133 kg ha^{-1} whereas the gmelina was significant to dalbergia thus interaction effect at fertilizer level all treatment trend found significant with dalbergia over to gmelina While for the gmelina was constant means P uptake varies 0.513 to 1.133 kg ha^{-1} whereas all treatment were significant to each other however maximum P uptake found in F_3 and minimum was estimated in F_1 thus increase the fertilizer levels the P uptake into gmelina. While dalbergia P uptake varies from 0.191 to 0.582 kg ha^{-1} whereas F_3 were significant to F_1 and F_2 however F_2 was at par with F_3 the fertilizer levels. P uptake (kg ha^{-1}) in mustard straw due to fertilizer levels varies from 0.084 to 0.122 kg ha^{-1} whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 fertilizer levels however the maximum P uptake has been found as F_3. The mean P uptake of gmelina and dalbergia varies from 0.092 to 0.109 whereas dalbergia was at par with gmelina. The interaction effect of

Gmelina and Dalbergia at F_1 was constant mean varies from 0.072 to 0.096 kg ha^{-1} however dalbergia was at par with gmelina and F_2 was constant the mean value 0.090 to 0.099 kg ha^{-1} whereas the dalbergia was at par with gmelina. When F_3 was constant mean values varies from 0.113 to 0.130 kg ha^{-1} whereas the dalbergia was at par with gmelina thus interaction effect at fertilizer levels all treatment trend found significant.While for the gmelina was constant means P uptake varies 0.096 to 0.130 kg ha^{-1} whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 thus increase the fertilizer levels the P uptake into gmelina. While Dalbergia P uptake varies from 0.072 to 0.113 kg ha^{-1} whereas F_3 was significant to F_1 and at par with F_2 however F_1 was at par with F_2 fertilizer levels P uptake also findings noted by Neha *et al.* 2014 [9].

K uptake (kg ha^{-1}) in mustard grain due to fertilizer levels varies from 3.97 to 8.91 kg ha^{-1} whereas all treatments were significant to each other fertilizer levels. However the maximum K uptake has been found as F_3 and minimum was estimated on F_1 fertilizer dose. The mean K uptake of gmelina and dalbergia varies from 5.51 to 6.86 kg ha^{-1} whereas gmelina was significant to dalbergia The interaction effect of gmelina and dalbergia at F_1 was constant mean varies from 3.39 to 4.56 kg ha^{-1} however dalbergia was at par with Gmelina and F_2 was constant the mean value 5.66 to 5.68 kg ha^{-1} whereas the dalbergia was at par with gmelina. When F_3 was constant mean values varies from 7.49 to 10.33 kg ha^{-1} whereas the gmelina was significant to dalbergia thus interaction effect at fertilizer level all treatment trend found significant with dalbergia over to gmelina While for the Gmelina was constant means K uptake varies 4.56 to 10.33 kg ha^{-1} whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 thus maximum P uptake found in F_3 thus increase the fertilizer dose the K uptake into gmelina. While dalbergia K uptake varies from 3.39 to 7.49 kg ha^{-1} whereas F_3 and F_2 were significant to F_1 however F_2 was at par with F_3 the fertilizer dose K uptake. uptake (kg ha^{-1}) in mustard straw due to fertilizer dose varies from 19.36 to 24.49 kg ha^{-1} whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 fertilizer dose at 5% of level of significant however the maximum K uptake has been found as F_3 and minimum was estimated on F_1 fertilizer dose. The mean K uptake of gmelina and dalbergia varies from 21.56 to 21.61 kg ha^{-1} whereas gmelina was at par with dalbergia. The interaction effect of Gmelina and Dalbergia at F_1 is constant mean varies from 18.03 to 20.69 kg ha^{-1} however dalbergia was at par with Gmelina and F_2 was constant the mean value 19.90 to 21.90 whereas the gmelina was at par with dalbergia. When F_3 was constant mean values varies from 24.09 to 24.90 kg ha^{-1} whereas the gmelina was at par with dalbergia. K uptake varies 19.90 to 24.09 kg ha^{-1} whereas all treatments were non-significant however maximum K uptake found in F_3 and minimum was estimated in F_2 thus increase the fertilizer dose the K uptake into gmelina. While dalbergia K uptake varies from 18.03 to 24.90 whereas F_3 was significant to F_1 and F_2 however F_1 was at par with F_2 fertilizer dose K uptake. Similar finding are found given nutrient uptake over 'Pusa Bold'. Combined application of 150 kg N and 25 kg S ha^{-1} to Indian mustard genotype was found more remunerative (Nayak *et al*., 2020) [8] The increase in uptake of N, P, K and S appeared due to cumulative effect of increased seed and straw yield and better contents of N, P, K and S both in seed and straw. These findings are in line with those noted by Parmar *et al*. (2011) [3] and Rajput (2017) [4].

Table 1: Nutrient (NPK) Content (%) on mustard crop under seed and straw (kg ha^{-1})

	Nitrogen Content						Phosphorus Content (%)						Potassium Content (%)					
	Gmelina		Dalbergia		Mean		Gmelina		Dalbergia		Mean		Gmelina		Dalbergia		Mean	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
F1	2.14	0.23	1.91	0.20	2.03	0.22	0.18	0.0063	0.09	0.0055	0.13	0.0059	1.6	3.91	1.5	3.81	1.6	3.86
F2	2.34	0.25	2.18	0.23	2.26	0.24	0.20	0.0068	0.13	0.0056	0.16	0.0062	1.5	4.96	1.9	4.76	1.7	4.86
F3	2.82	0.28	2.37	0.24	2.59	0.26	0.28	0.0074	0.20	0.0062	0.24	0.0068	2.6	6.49	2.5	3.81	2.6	6.42
mean	2.43	0.25	2.15	0.22		0.22	0.22	0.0069	0.14	0.0058		0.0059	1.9	5.12	2.0	4.97		

Table 2: Nutrient (NPK) absorption by mustard crop (seed and straw) (kg ha^{-1})

Treatment	Nutrient absorption (N, kg ha^{-1})					
	Gmelina		Dalbergia		Mean	
	Grain	straw	Grain	straw	Grain	straw
F1	6.01	3.52	4.30	2.65	5.16	3.08
F2	9.08	3.60	6.56	3.61	7.82	3.61
F3	11.34	4.99	7.06	4.29	9.20	4.64
Mean	8.81	4.04	5.97	3.52		
	System (A)		Fertilizer (B)		A X B	
SEm±	0.43	0.21	0.53	0.26	0.75	0.36
CD (5%)	1.30	0.63	1.59	0.78	2.25	1.10

Nutrient absorption (P, kg ha^{-1})					
Gmelina		Dalbergia		Mean	
Grain	straw	Grain	straw	Grain	straw
0.513	0.096	0.191	0.072	0.352	0.084
0.792	0.099	0.376	0.090	0.584	0.095
1.133	0.130	0.582	0.113	0.858	0.122
0.813	0.109	0.383	0.092		
System (A)		Fertilizer (B)		A X B	
0.040	0.006	0.049	0.007	0.069	0.010
0.120	0.017	0.147	0.021	0.207	0.029

Nutrient absorption (K, kg ha^{-1})					
Gmelina		**Dalbergia**		**Mean**	
Grain	straw	Grain	straw	Grain	straw
4.56	20.69	3.39	18.03	3.97	19.36
5.68	19.90	5.66	21.90	5.67	20.90
10.33	24.09	7.49	24.90	8.91	24.49
6.86	21.56	5.51	21.61		
System (A)		Fertilizer (B)		A X B	
0.39	1.19	0.48	1.45	1.19	0.48
1.18	3.58	1.44	4.38	3.58	1.44

Conclusion

Nutrient uptake of fertilizer levels have different absorption capacity and it seem to highest was found under F_3 fertilizer levels in both systems moreover the Gmelina based agroforestry system have given higher nutrient content percentage and uptake was estimated as compare to Dalbergia based agroforestry system. Nutrient absorption of N and P (kg ha^{-1}) were estimated higher in grain followed by straw but in case of K (kg ha^{-1}) was estimated maximum in straw followed by grain under both agroforestry systems.

References

1. Nair PKR, Rosa Mosquera-Losada M. Agroforestry: An overview Science Direct Topics Encyclopedia of Ecology, 2008.
2. Marney Isaac E, Kira Borden A. Nutrient acquisition strategies in agroforestry systems, Plant and Soil. 2019;444:1-19.
3. Parmar RM, Parmar JK, Patel MK. Effect of nitrogen and sulphur on content and uptake of nutrient by mustard crop under the loamy sand soil of North Gujarat. International Journal of Agricultural Sciences. 2011;7(1):103-106.
4. Rajput RK. Effect of Nitrogen and Sulphur levels on nutrients uptake and yield of Indian mustard [*Brassica juncea* (L.) Czern & Coss.]. International Archive of Applied Sciences and Technology. 2017;8(3):29-31.
5. Karthikeyan K, Shukla LM. Effect of boron-sulphur interaction on their uptake and quality parameters of mustard (*Brassica juncea* L.) and sunflower (*Helianthus annuus* L). Journal of the Indian Society of Soil Science. 2008;56(2):225-230
6. Keerthi P, Pannu RK, Dhaka AK, Daniel J, Yogesh. Yield, Nitrogen Uptake and Nutrient Use Efficiency in Indian Mustard (*Brassica juncea* [L.]) As Effected by Date of Sowing and Nitrogen Levels in Western Haryana, India. Int. J Curr. Microbiol. App. Sci. 2017;6(4):1168-1177.
7. Reager ML, Sharma SK, Yadav RS. Yield attributes, yield and nutrient uptake of Indian mustard (*Brassica juncea*) as influenced by nitrogen levels and its split application in arid western Rajasthan. Indian J Agron. 2006;51(3):213-216.
8. Nayak H, Bohra JS, Yadav SP. Growth and nutrient uptake of Indian mustard [*Brassica juncea* (L.) Czern and Coss.] genotypes as influenced by nitrogen and Sulphur fertilization under irrigated condition. Eco. Env. & Cons. 2020, November 26, S79-S83.
9. Neha, Dashora LN, Kaushik MK, Upadhyay B. Yield, nutrient content, uptake and quality of Indian mustard genotypes as influenced by sulphur under Southern Rajasthan conditions. Annals of Agri Bio Research. 2014;19(1):81-84.