International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125, Impact Factor: RJIF 5.28
Received: 06-02-2021, Accepted: 09-03-2021, Published: 31-03-2021
Volume 3, Issue 1, 2021, Page No. 485-489

Impact of crop Bio-Intensification and nutrient management on production and productivity of lentil crop under North West Himalayan region of Jammu-Kashmir

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Abstract
The experiment was performed in *rabi*, *zaid* and *kharif* seasons of 2013-14 and 2014-15 to study the bio-intensification possibilities in different cropping systems at Research Farm, FSR center, Main Campus, Chatha, SKUAST-Jammu, Jammu & Kashmir, India located at an latitude of 32^0 40' N and Longitude 74^0. 58'E with an altitude of 332 m above mean sea level. The experiment was laid out in randomized block design (factorial) with 15 treatments and three replications. Treatments comprised of five crop bio-intensification treatments *viz*., Wheat–Rice, Wheat (FIRB) + Lentil (Border) – Moongbean– *Sesbania* (Brown Manuring) + Rice (Furrow) + Moongbean (Flat Bed), Lentil (Broad Bed) + Mustard (Border)–Moongbean–Maize (Broad Bed) + Sorghum (Furrow), Mustard + Gobi Sarson–Moongbean–Rice (Furrow) + Moongbean (Flat Bed), Wheat + Mustard (6:1)–Moongbean–Maize (Flat Bed) + Cowpea (Border) and three nutrient management practices *viz*., 100% Organic, 100% Inorganic and Integrated Nutrient Management (50:50 RDF through inorganic and organic (FYM)). The plot size was 4.90 m × 3 m with 2 m border and buffer zone on both sides to curtail water run-off between adjacent plots. Under different treatments (crop bio-intensification and nutrient management) the grain yield, straw yield and total bio-mass (q. /ha.) of lentil was found varying. Grain yield, straw yield and total bio-mass of lentil was observed more in second year *rabi 20*15-16 than first year *rabi* 2014-15, whereas among crop bio-intensification, lentil crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean - Maize (B) + Sorghum (F) practice produced grain yield, straw yield and total bio-mass than the crop sown under Wheat (FIRB)+Lentil (B)-Summer Moongbean -BM+ Rice (F)+ Moongbean (B) during both the years of experimentation. Among nutrient management**,** it has been observed that application of 100 % in- organic showed higher grain yield, straw yield and total bio-mass, than 100% organic (FYM) and INM (50:50) during first and second year of experimentations.

Keywords: crop bio-intensification, nutrient management, production, lentil crop

Introduction

Lentil (*Lens culinaris Medic.*) is one of the oldest annual grain legumes consumed and cultivated in the world. Originating from South western Asia as early as 6000 B.C., lentil is rich in proteins and contains high concentrations of essential amino acids like isoleucine and lysine, as well as other nutrients like dietary fiber, folate, vitamin B1, and minerals (Rozan *et al.,* 2001) [5]. Lentil is widely consumed in various parts of the world as loaves, soups, pies, curries etc., especially in vegetarian cultures. It is also an important source of dietary protein in the Mediterranean and South Asian regions. Lentil is a cool season pulse crop and is also relatively tolerant to drought.

The crop bio-intensification concept envisages habitat modification for beneficial organisms, development of healthy and biologically active soils, maintaining uncultivated lands for diversity of flora and fauna, developing entomophage parks within existing cropping system for food, fiber and fuel and shelter to diverse beneficial insects, weed strips, hedge rows, inter crops and conservation of insect bio diversity. This bio-intensive approach needs building the knowledge and information infrastructure by making changes in research and education priorities in order to emphasize ecology-based crop management to redesign its management.

In addition to this, nutrient management practices has also the long term benefit of carbon sequestration and improved soil health resulting in high crop yields, as it helps to maintain balances nutrient supply, check multi nutrient deficiencies and sustain crop yield. Fertilizers have constituted yet another key input in achieving goals of high production and productivity. To ensure adequate and balanced nutrient supply, integrated approach is an important option and involves more efficient use of chemical fertilizers in conjunction with judicious use of organic manures without deteriorate to soil fertility and improving crop productivity more particulars under the crop bio-intensification technologies there by help to integrated nutrient supply improve the physical, chemical and biological health of soil and avoid soil degradation and deterioration of water and environmental quality. Besides, organic sources of nutrients acts as slow release fertilizers as it synchronizes the nutrient demand set by plants, both in time and space, with supply of nutrients from the labile soil and applied nutrient pools.

Material and Methods

The experiment was performed during the two years (2013-14 and 2014-15) at at the Research Farm, FSR center, Main Campus,

Chatha of SKUAST–Jammu, during rabi, zayad and kharif seasons on clay loam soil to study the effect of crop bio-intensification and nutrient management on productivity and sustainability of various cropping. The experiment was laid out in factorial randomized block design with three replications. The treatments consisted of two crop- bio intensification (i.e. B_1 = Wheat (FIRB)+Lentil (B) – Moongbean – Brown Manuring +Rice (F) + Moongbean (Bed), B_2= Lentil (BB) + Mustard (B) – Moongbean –Maize (BB)+ Sorghum (F), and three nutrient management practices (i.e N_1 =100% Organic (RDF through FYM), N_2 = 100% Inorganic (RDF), N_3 =Integrated Nutrient Management (INM) 50:50 (50% NPK through + 50 % N through FYM). The soil of the experimental field was clay loam in texture, slightly alkaline in reaction, low in organic carbon and available nitrogen and medium in available phosphorous and potassium.

Results and Discussion

The growth of lentil crop like plant height (cm) and dry matter accumulation (g/plant) were comparatively less during the first year of experimentation, which might be due to better climate conditions during second year.

Among crop bio-intensification, lentil crop sown under Wheat (FIRB) +Lentil (B)-Summer Moongbean -BM+ Rice (F) +Moongbean (B) practice recorded taller plants at all the growth stages of crop up to harvest than the crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean- Maize (B) + Sorghum (F) crop bio-intensification practice during both of the years at all crop growth stages up to harvest. It might be due competition of light, solar radiation is more in Lentil (BB) + Mustard (B) – Summer Moongbean- Maize (B) + Sorghum (F). This result is in confirmation with Alla *et al* (2014) [1].

However, among nutrient management, application of 100% in-organic recorded taller plants than 100% organic (FYM) and INM (50:50) during both of the years at all crop growth stages up to harvest. It might be due to relatively slow nutrient release by 100% organic (FYM). Subhashini *et al.* (2007) [4] reported that organic source of nutrient release relatively slow nutrient as compared to chemical fertilizer.

Yield and yield Attributes of lentil *viz;* number of pods per plant, number of branches per plant, number of grains per pod, test weight grain yield (q/ha), straw yield (q/ha) and total bio-mass (q/ha) were observed higher during second year than first year, which probably due to better environmental condition during second year.

Under crop bio-intensification, lentil crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean - Maize (B) + Sorghum (F) produce higher number of pods per plant, number of branches per plant, number of grains per pod, test weight, grain yield (q/ha), straw yield (q/ha) and total bio-mass (q/ha) than Wheat (FIRB)+Lentil (B)-Summer Moongbean -BM+ Rice (F)+ Moongbean (B). Application of 100% in-organic recorded higher number of pods per plant, number of branches per plant, number of grains per pod, test weight, grain yield (q/ha), straw yield (q/ha) and total bio-mass (q/ha) than 100% organic (FYM) and INM (50:50) during both years of experimentations. It might be due to more nutrient release under in-organic sources of nutrient (Kunari *et al;*2010 and Chaudhary *et al;*2011) [3, 2] and availability nutrients compared than organic nutrient sources, which have relatively slow nutrient release and may achieve yield stability in the long run (Subhashini *et al;*2007) [4].

Table 1: Plant height (cm.) of lentil as influenced by bio-intensification and nutrient management

Treatments	30 DAS		60 DAS		90 DAS		120 DAS		At Harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
A- Crop Bio-intensification										
W-R	-	-	-	-	-	-	-	-	-	-
W(FIRB)+L(B)-SM-BM+R(F)+M(B)	9.33	9.52	17.42	17.77	32.73	33.39	44.30	45.18	45.14	46.05
L(BB)+M(B)-SM-MZ(BB)+S(F)	8.53	8.70	16.67	17.01	31.77	32.40	43.18	44.04	43.81	44.69
M+GS-SM-R(F)+MB (B)	-	-	-	-	-	-	-	-	-	-
W+M(6:1)-SM-MZ(B)+C(B)	-	-	-	-	-	-	-	-	-	-
B-Nutrient Management										
100% organic (FYM)	7.87	8.02	16.09	16.41	29.95	30.55	41.77	42.60	42.53	43.38
100% In organic	10.15	10.35	18.37	18.74	35.45	36.16	45.70	46.61	46.23	47.15
INM (50:50)	8.79	8.96	16.68	17.01	31.35	31.98	43.75	44.62	44.67	45.56

W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson, MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer Moongbean

Table 2: Dry Matter Production (g/plant) of lentil as influenced by bio-intensification and nutrient management

Treatments	30 DAS		60 DAS		90 DAS		120 DAS		At Harvest	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
A- Crop Bio-Intensification										
W-R	-	-	-	-	-	-	-	-	-	-
W(FIRB)+L(B)-SM-BM+R(F)+M(B)	0.52	0.54	3.17	3.33	4.95	6.09	7.09	8.72	7.69	9.45
L(BB)+M(B)-SM-MZ(BB)+S(F)	0.50	0.52	2.85	3.00	4.45	5.44	6.48	7.97	7.49	9.21
M+GS-SM-R(F)+MB (B)	-	-	-	-	-	-	-	-	-	-
W+M(6:1)-SM-MZ(B)+C(B)	-	-	-	-	-	-	-	-	-	-
B-Nutrient Management										
100% organic (FYM)	0.50	0.52	2.30	2.42	4.05	4.98	6.05	7.44	7.15	8.79
100% In organic	0.53	0.55	3.55	3.73	5.34	6.51	7.57	9.31	8.04	9.89
INM (50:50)	0.51	0.53	3.18	3.34	4.72	5.81	6.75	8.30	7.58	9.32

W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson, MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer Moongbean

Table 3: Yield attributes of lentil as influenced by bio-intensification and nutrient management

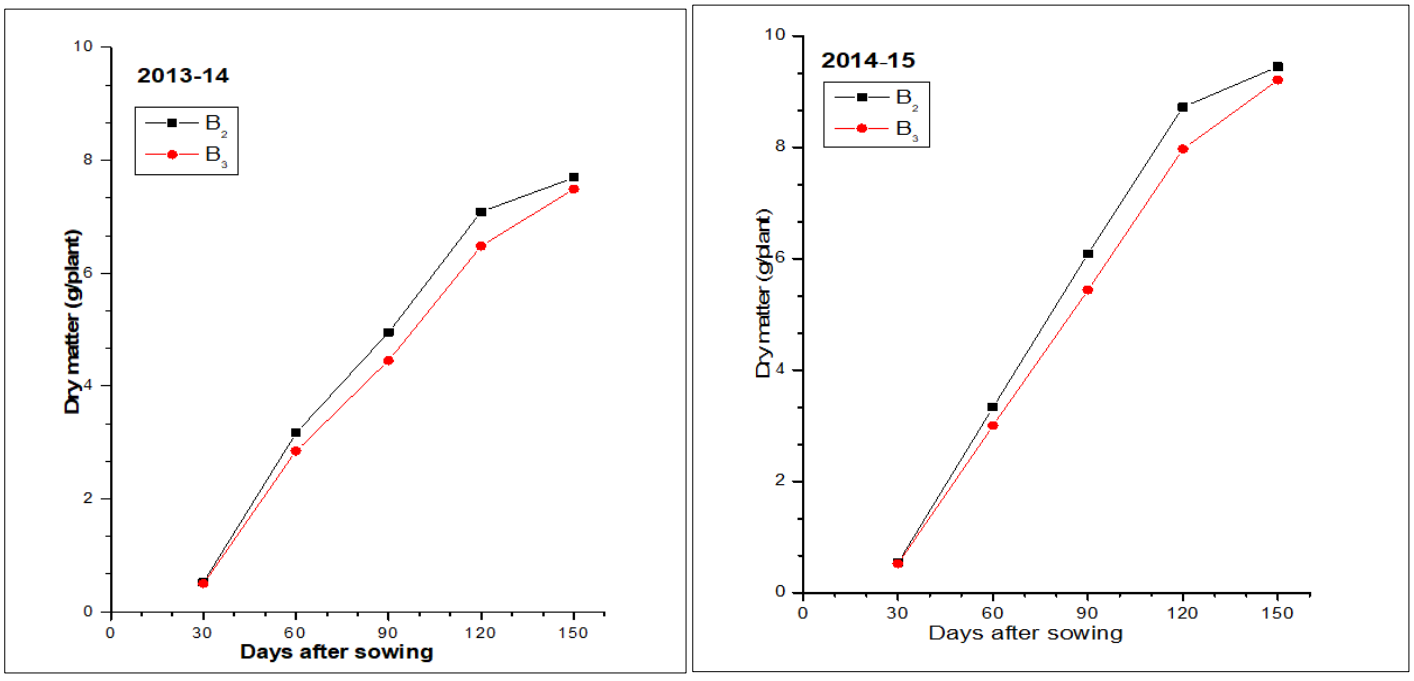
Treatments	No. of pods / plant		No. of branches / plant		No. of grains / pod		Test Weight (g)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
A- Crop Bio-Intensification								
W-R	-	-	-	-	-	-	-	-
W(FIRB)+L(B)-SM-BM+R(F)+M(B)	83.67	85.34	19.86	20.26	1.56	1.59	20.50	21.22
L(BB)+M(B)-SM-MZ(BB)+S(F)	86.33	88.06	21.12	21.54	1.78	1.81	20.87	21.28
M+GS-SM-R(F)+MB (B)	-	-	-	-	-	-	-	-
W+M(6:1)-SM-MZ(B)+C(B)	-	-	-	-	-	-	-	-
B-Nutrient Management								
100% organic (FYM)	81.01	82.62	18.07	18.43	1.50	1.70	20.40	20.96
100% In organic	90.00	91.8	23.32	23.78	1.84	1.70	21.10	21.57
INM (50:50)	84.00	85.68	20.09	20.49	1.67	1.76	20.55	21.22

W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson, MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer Moongbean

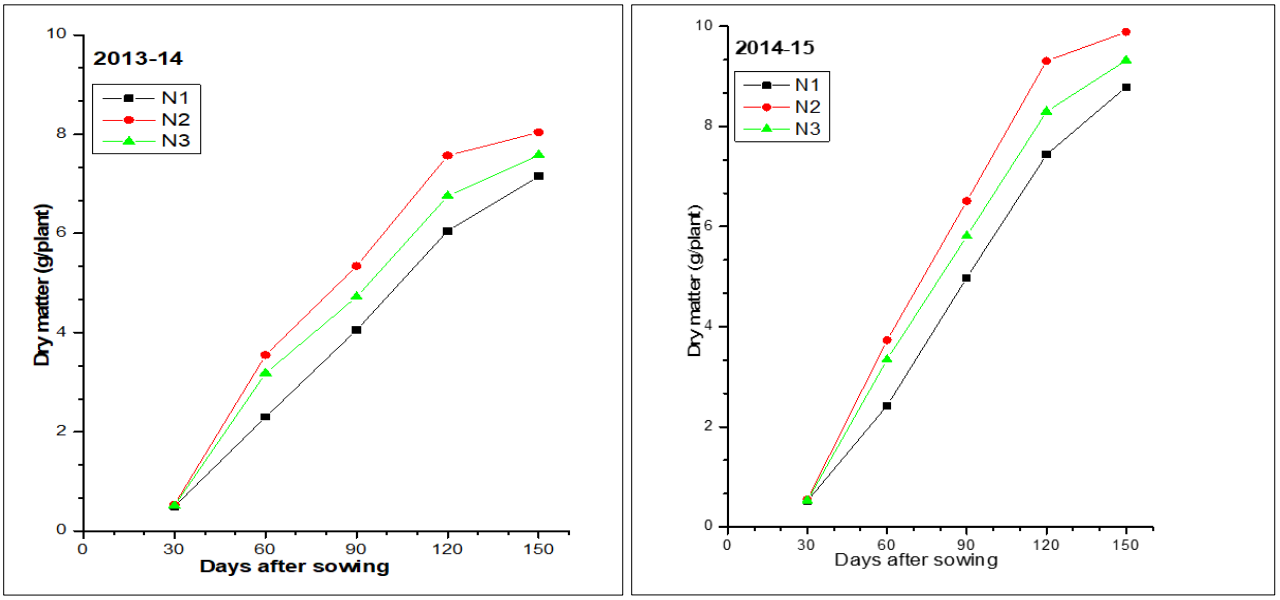
Table 4: Individual yield (q/ha.) of lentil as influenced by bio-intensification and nutrient management

Treatment	Grain yield (q/ha.)		Straw yield (q/ha.)		Total Bio-mass (q/ha.)	
	2013-14	2014-15	2013-14	2014-15	2013-14	2014-15
A - Crop Bio-Intensification						
W-R	-	-	-	-	-	-
W(FIRB)+L(B)-SM-BM+R(F)+M(B)	6.18	6.34	14.8	15.22	21.03	21.56
L(BB)+M(B)-SM-MZ(BB)+S(F)	9.34	9.56	22.42	22.96	31.76	32.52
M+GS-SM-R(F)+MB (B)	-	-	-	-	-	-
W+M(6:1)-SM-MZ(B)+C(B)	-	-	-	-	-	-
B-Nutrient Management						
100% organic (FYM)	6.93	7.14	16.56	17.05	23.49	24.19
100% In organic	8.57	8.67	20.65	20.91	29.22	29.58
INM (50:50)	7.78	8.04	18.68	19.30	26.47	27.35

W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson, MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer Moong



(a)



(b)

Fig 1: Individual dry matter (g/plant) of Lentil intercropped with, wheat and mustard crop at different row ratio as influenced by crop bio-intensification (a) and nutrient management practices (b).

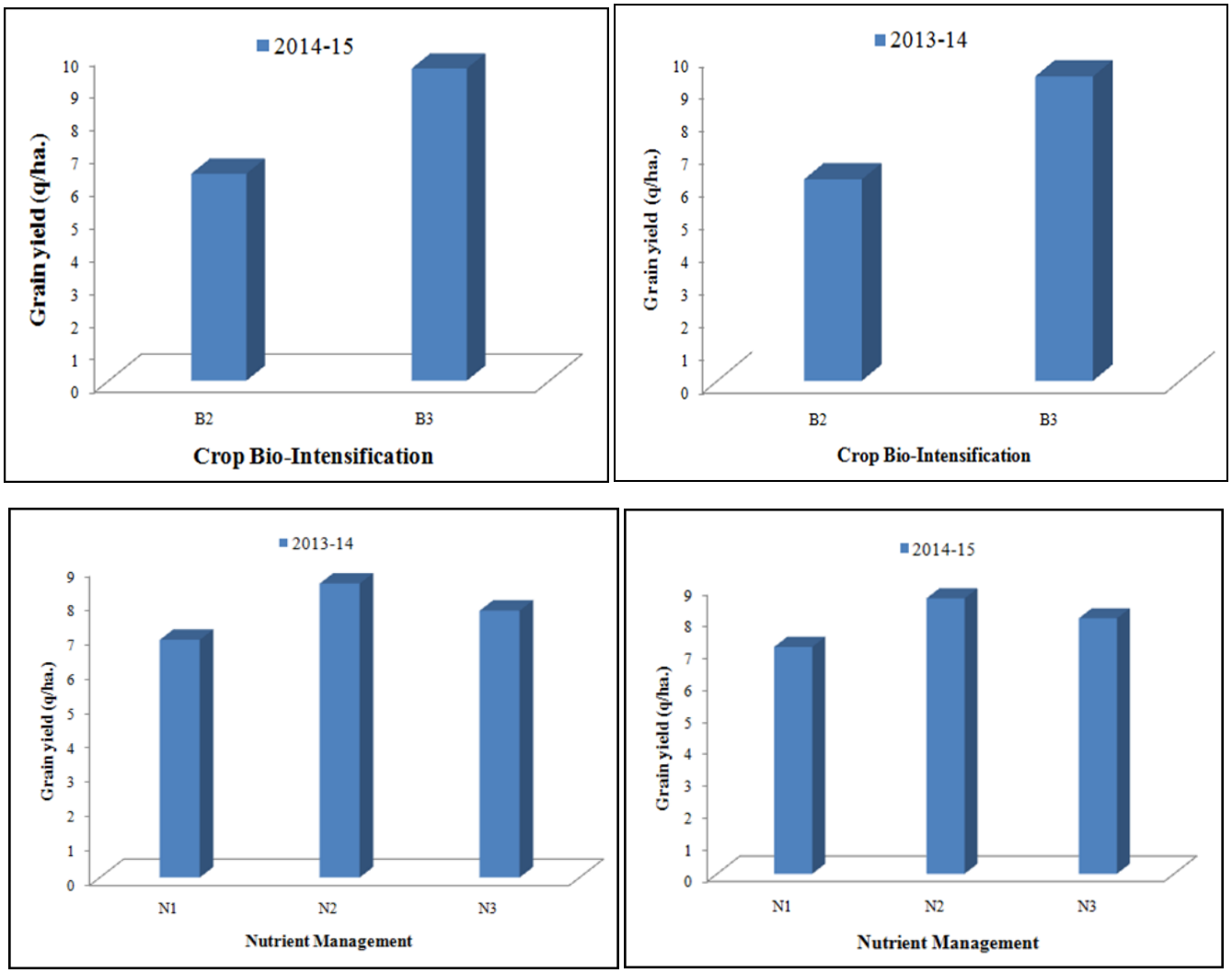


Fig 2: Individual yield of Lentil (q/ha) intercropped with wheat and mustard at different row ratios as influenced by bio-intensification and nutrient management

Crop Bio-intensification : B_1 = Wheat–Rice; B_2 = Wheat (FIRB)+Lentil (B) – Moongbean – Brown Manuring +Rice (F) + Moongbean (Bed); B_3= Lentil (BB) + Mustard (B) – Moongbean –Maize (BB) + Sorghum (F); B_4= Mustard + Gobi Sarson – Moongbean– Rice(F)+ Moongbean(Bed); B_5– Wheat + Mustard (6:1) – Moongbean– Maize (Bed)+Cowpea(B)

Nutrient Management : N_1 =100% Organic (RDF through FYM); N_2 = 100% Inorganic (RDF through fertilizer); N_3 =Integrated Nutrient Management (INM) (50:50) {50% NPK through Fertilizer + 50% N through FYM}

Conclusion

From the above experiment it can be concluded that among crop bio-intensification, lentil crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean - Maize (B) + Sorghum (F) practice produced grain yield, straw yield and total bio-mass than the crop sown under Wheat (FIRB)+Lentil (B)-Summer Moongbean - BM+ Rice (F)+ Moongbean (B), whereas among nutrient management**,** application of 100 % in- organic showed higher grain yield, straw yield and total bio-mass, than 100% organic (FYM) and INM (50:50).

References

1. Alla Hamd, Shalaby WA, Dawood EM, Zohry RA, A. A. Effect of Cowpea (*Vigna sinensis* L.) with Maize (*Zea mays* L.) Intercropping on Yield and Its Components, International Journal of Biological, Biomolecular, Agricultural, Food and Biotechnological Engineering.2014:8(11):1263-69.
2. Chaudhary SK, Singh JP, Jha S. Effect of integrated nitrogen management on yield, quality and nutrient uptake of rice under different date of planting. Indian Journal of Agronomy 2011:56(3):228-31.
3. Kunari N, Singh AK, Pal SK, Thakur R. Effect of organic nutrient management on yield, nutrient uptake and balance sheet in scented rice. Indian Journal of Agronomy. 2010:55(3):220-23.
4. Subashini HD, Malarvannan S, Kumaran P. Effect of bio-fertilizers (N-Fixers) on the yield of rice varieties at Pondicherry, India. Asian Journal of Agriculture Research.2007:1(3):146-50.
5. Rozan P, Kuo YH, Lambein F. Amino acids in seeds and seedlings of the genus Lens. Phytochemistry.2001:58:281-289.