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Impact of Crop Bio-Intensification and Nutrient Management on Production and Productivity of Maize Crop under North West Himalayan Region of Jammu -Kashmir

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ABSTRACT

A field experiment was conducted during for two years (2015 and 2016) 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. Under different treatments (crop bio-intensification and nutrient management) the grain yield, straw yield and total bio-mass (q/ha) of maize was found varying. The grain yield, straw yield and total bio-mass of maize was observed more in second year *kharif* 2015 than first year *kharif* 2016. Among crop bio-intensification, maize crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean –Maize (BB) + Sorghum (F) practice produced higher grain yield (30.16 q/ha and 31.50 q/ha) than the crop sown under wheat + mustard (6:1) –Summer moongbean – maize (bed) + Cowpea (B) (26.03 q/ha and 26.78 q/ha) during both of the years of experimentations. The same trend was observed with straw yield and total bio-mass. 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) during 1st and 2nd years of experimentations.

Keywords Crop bio-intensification, Nutrient management, Maize, Production.

INTRODUCTION

The dominant cropping system in the Jammu region of Jammu and Kashmir is Maize-Wheat cropping system. Maize is the third most important cereal crop of world as well as in the state and in India after wheat and rice. Maize has diversified uses as food for human, feed for livestock and raw material in industries. Out of the total production 45% is consumed as staple food in various forms. Maize alone accounts 30% of total global grain production and the crop is cultivated on 161.11 m ha of land worldwide producing 826.22

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mt with an average yield of 51.28 q/ha (Anonymous 2017). In India maize is grown on 8.49 million ha with production and productivity of 21.49 million tons and 2.51 tons per hectare, respectively. It is a miracle crop because of its high potential yield and is also known as 'queen of cereals'. In J and K state maize has special significance because it forms the staple diet of majority of people. The total area under maize crop in the state is about 308.22 thousand hectare, having a production and productivity of 4098 thousand quintal and 18.72 q/ha, respectively (Anonymous 2017 a) which is low as compared to average national productivity. Maize crop being C_4 plant has tremendous yield potential and responds well to applied inputs and is grown under both the irrigated and rain fed ecosystems and hence is having wider adaptability with respect to season and altitude and is having the potential to mitigate the effect of climate change being C_4 plants there by having higher temperature optimum for photosynthesis and growth than C_3 plants.

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.

MATERIALS AND METHODS

The experiment was performed during the two years (2015 and 2016) 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 five crop-bio intensification (i.e.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), 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 phosphorus and potassium.

RESULTS AND DISCUSSION

Tables 1 and 2 show data on the growth parameters of maize 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 favorable climatic conditions during second year.

Among crop bio-intensification, maize crop sown under Wheat + Mustard (6:1) – Summer Moong-

Table 1. Plant height (cm) of maize as influenced by bio-intensification and nutrient management. W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson , MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer moongbean.

Treatments	30 DAS		60 DAS		90 DAS		At harvest	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
A- crop bio-intensification								
W-R	-	-	-	-	-	-	-	-
W(FIRB)+L (B)-SM-BM+R (F)+M (B)	-	-	-	-	-	-	-	-
L (BB)+M (B)-SM-MZ (BB)+S (F)	53.16	54.76	112.64	116.02	161.80	166.65	182.32	187.79
M+GS-SM-R (F)+MB (B)	-	-	-	-	-	-	-	-
W+M (6:1)-SM-MZ (B)+C (B)	54.21	55.83	114.28	117.70	163.54	168.45	184.64	190.18
B-nutrient management								
100% organic (FYM)	51.03	52.56	109.27	112.55	159.28	164.06	180.16	185.56
100% inorganic	55.88	57.55	116.84	120.34	166.04	171.02	186.84	192.45
INM (50:50)	54.16	55.78	114.27	117.70	162.70	167.58	183.43	188.93

bean– Maize (Bed) + Cowpea (B) practice showed higher trend in terms of taller plants and dry matter accumulation at all the growth stages of crop up to harvest than Lentil (BB) + Mustard (B) – Summer Moongbean –Maize (BB) + Sorghum (F) during both of the years of experimentation at all crop growth stages up to harvest. This might be due to supplemental dose of nutrients to pulse crops which further provided nutrients to maize crop. Moreover, the crop sequence involving legumes played an important role in restoring the soil fertility in terms of N and other biological parameters due to atmospheric N-fixation through symbiotic process, which in turn improved the yield of succeeding crop compared with that of the cereal- cereal crop sequence (Ramesh and Reddy 2004).

Among nutrient management treatments, 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 fast release of nutrients by in-organic fertilizers as compared to organic and INM treatments.

Yield attributes and yield

Tables 3 and 4 contains information on the yield attri-

Table 2. Dry matter production (g/plant) maize as influenced by bio-intensification and nutrient management. W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson , MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer moongbean.

Treatments	30 DAS		60 DAS		90 DAS		At harvest	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
A- crop bio-intensification								
W-R	-	-	-	-	-	-	-	-
W(FIRB)+L (B)-SM-BM+R (F)+M (B)	-	-	-	-	-	-	-	-
L (BB)+M (B)-SM-MZ (BB)+S (F)	4.97	5.21	49.307	50.363	94.513	94.855	123.547	124.073
M+GS-SM-R (F)+MB (B)	-	-	-	-	-	-	-	-
W+M (6:1)-SM-MZ (B)+C (B)	5.17	5.32	50.917	52.354	95.960	96.689	125.140	125.714
B-nutrient management								
100% organic (FYM)	4.90	5.09	47.615	48.953	92.895	93.017	122.445	122.938
100% inorganic	5.20	5.40	52.445	53.428	97.485	98.260	126.570	127.187
INM (50:50)	5.10	5.30	50.275	51.693	95.330	96.040	124.015	124.555

Table 3. Yield attributes of maize as influenced by bio-intensification and nutrient management. W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson , MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer moongbean.

Treatments	No of cob/ plant		No of grains/cob		Test weight (g)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
A- crop bio-intensification						
W-R	-	-	-	-	-	-
W(FIRB)+L (B)-SM-BM+R (F)+M (B)	-	-	-	-	-	-
L (BB)+M (B)-SM-MZ (BB)+S (F)	1.42	1.46	211.84	218.19	171.77	176.92
M+GS-SM-R (F)+MB (B)	-	-	-	-	-	-
W+M (6:1)-SM-MZ (B)+C (B)	1.49	1.53	216.07	222.55	173.01	178.2003
B-nutrient management						
100% organic (FYM)	1.41	1.45	206.79	212.99	169.56	174.65
100% inorganic	1.525	1.57	221.89	228.55	177.455	182.78
INM (50:50)	1.425	1.47	213.18	219.58	170.15	175.25

Table 4. Yield (q/ha.) maize of as influenced by bio-intensification and nutrient management. W-Wheat, R-Rice, L-Lentil, M-Mustard, GS-Gobhi Sarson , MZ-Maize, S-Sorghum, C-Cowpea, MB-Moongbean, SM-Summer moongbean.

Treatments	Grain yield (q/ha.)		Straw yield (q/ha.)		Total bio-mass (q/ha.)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year
A - crop bio-intensification						
W-R	-	-	-	-	-	-
W (FIRB) + L (B)-SM-BM+R (F)+M (B)		-	-	-	-	- -
L (BB)+M (B)-SM-MZ (BB)+S (F)	30.16	31.50	84.16	87.88	114.32	119.38
M+GS-SM-R (F)+MB (B)	-	-	-	-	-	-
W+M (6:1)-SM-MZ (B)+C (B)	26.03	26.78	72.65	74.74	98.68	101.52
B-nutrient management						
100% organic (FYM)	25.87	27.03	71.92	75.13	97.79	102.16
100% inorganic	29.72	30.63	83.22	85.77	112.94	116.40
INM (50:50)	28.7	29.76	80.073	83.03	108.77	112.79

butes and yield of maize viz. number of cob per plant, number of grains per cob, and test weight (g), grain yield (q/ha), straw yield (q/ha) and total bio-mass (q/ha) were observed higher during 1st year than 2nd year, which probably due to favorable environmental conditions during second year.

Maize crop sown under crop bio-intensification Wheat + Mustard (6:1) – Summer Moongbean– Maize (Bed) + Cowpea (B) practice recorded higher yield attributes than the crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean –Maize (BB) + Sorghum (F) crop bio-intensification practice during both the years of experimentation. However, higher yield was recorded under Lentil (BB) + Mustard (B) – Summer Moongbean –Maize (BB) + Sorghum (F) crop bio-intensification. This might be due to higher plant population of maize crop per unit area under Lentil (BB) + Mustard (B) – Summer Moongbean – Maize (BB) + Sorghum (F) crop bio-intensification. Whereas in relation to yield attributes it might be due to the effect of legume crop (lentil and moongbean). Dwivedi and Awasthi (2017) also reported that legumes enrich soil by fixing the atmospheric nitrogen

which further converted in to inorganic forms that are readily available for plant uptake.

Among nutrient management treatments, application of 100% in-organic recorded higher cob per plant, grains per cob and test weight than 100% organic (FYM) and INM (50:50) during 1st and 2nd years of experimentation. It might be due to fast release of nutrients from in-organic fertilizers as compared to organic and INM treatments.

CONCLUSION

Based on the findings of the present study, it can be concluded that, Among crop bio-intensification, maize crop sown under Lentil (BB) + Mustard (B) – Summer Moongbean –Maize (BB) + Sorghum (F) practice produced higher grain yield whereas under nutrient management 100% inorganic practice produced higher grain yield.

REFERENCES

Annonymous (2016-17a) Economic survey. Directorate of Economics and statistics, department of agriculture and cooperation, Ministry of Agriculture. Government of India, New Delhi.

Anonymous (2017) Area, production and productivity of maize of India. Directorate of Economics and Statistics, department of agriculture and co-operation. Ministry of Agriculture.Government of India, New Delhi.

Dwivedi RN, Awasthi RP (2017) Studies on intercropping of soybean in maize under agroclimatic conditions of Nagaland. *Indian Agriculturist* 30 : 307— 311.