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Impact of varietal and growth regulator treatments on morpho-physiological characters and quality of Mungbean (V*igna radiata* (l) wilczek)

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Abstract

A field experiment was conducted during summer season 2012 and 2013 at the research farm R.B.S. college Agra, U.P., to find out the effect of different levels of growth regulator on germination percent, germination energy, seed vigour and other characters of Pant mung-5, K-851,SML-668 and Pusa-9072 varieties of mungbean. The significant higher increment was observed in varieties Pant mung-5, P-9072, SML-668 and K-851 under 2,4-D treatments dose 10^{-3} in germination percent and plumule length and radical length in both the years. The maximum germination energy was recorded in varieties Pant mung-5 and K-851 under GA treatment dose 10^{-1}. The vigour index, number of seed pod^{-1} and 100 seed weight by all varieties gave superior results in both the years. All experimental varieties of mungbean under BA treatment at 10^{-1} dose reported highest plant height.

Key words : growth regulator, germination percent and seed vigor

Introduction

India is the largest pulses producing country in the world. Pulses are mainly grown in rain fed area. Mungbean (*Vigna radiata* L.) is considered as one of the most important pulse crop in India. It is important legume crop characterized by a relative high content of protein (22%) and short summer season crop. It is one of important pulse crop cultivated in India ranking third having about 70% of the world area and 45% of production. In India area occupied by mungbean is about 23.63 million ha with total production of 14.56 million tones but average productivity (625 kg/ha) is quite low. The various application of optimum quantity of growth regulators play an important role in high germination and vigor percent in mungbean (*Aldesuquy et.al.2007*) and (*Algan et.al.2011*). The remarkable research work has not been conducted under arid, semi arid and rain fed conditions to find out the proper doses of growth regulator application for getting high germination percent, vigour index and productivity in mungbean. Keeping in view the above facts the present study was under taken to find out the effect of application of growth regulator on germination, vigour, productivity and other characters in different varieties of mungbean viz.- Pant mung-5, K-851,SML-668 and Pusa-9072 under Agra region.

Materials and Methods

A field experiment was conducted during summer season 2012 and 2013 at the research farm R.B.S. college Agra, U.P., to find out the effect of four levels viz, control, 10^{-1}, 10^{-2}, $10^{-3}$of growth regulators on germination percent, germination energy, seed vigour and other characters of four varieties viz, Pant mung-5, K-851, SML-668 and Pusa-9072 of mungbean. Agra is situated at 27° 11’0" N and 78°1’0" E longitude at an altitude of 171m above mean sea level and has a subtropical climate with dry hot summers and cold winters. The mean maximum temperature during the hottest month (June) ranges between 41-48°C, while mean minimum temperature in the coldest months (December-January) ranges between 2-8°C. Of the average annual rainfall of 695 mm, about 88% is received between June and October and the rest during winters. The experimental design was factorial randomized block with three replications. Urea was the source of nitrogen and the source of sulphur was gypsum while triple super-phosphate was used as source of phosphorus but in case of Potash in soil was rich. The physiological parameters viz, Relative growth rate (RGR), Absolute crop growth rate (ACGR), Net assimilation rate (NAR) and Harvest index (HI) were calculated applying the formulae giving by (*Waston, 1952*). Observations were recorded time to time on germination percentage, germination energy, vigour index, radicle length, plumules length, plant height, number of seeds pod^{-1} and 100 seed weight. The data collected in the experiment for different characters were subjected to statistical test for significance and analysis of variance. Critical difference (CD) values at 5% probability level were computed for making comparisons between treatments. Association between

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yield and its contributing characters were determined by multiple correlations method and the dependence of yield on its important contributing morphological characters were also determined by the multiple regression method suggested by (*Cochran, and Cox, 1967*).

Results and Discussion

The results obtained in this study are presented and discussed as under.

Germination percent

The results presented in Table 1 showed that priming with growth regulator viz; TIBA and 2, 4-D significantly increased the germination percentage at initial stage in all the varieties as compared to other growth regulators. At lower concentrations of TIBA and 2,4-D the germination percentage was maximum. The maximum germination percentage (67.34) was recorded at in 10^{-3} doses of 2,4-D and the minimum germination percentage (35.34) was recorded in 10^{-1} BA. These findings are in concordance with the reports of (*Medhi et, al. 2005*) among all the four varieties of mung bean increase in seed germination with all the growth regulators over control. In present investigation all the four varieties and in both the years that 2,4-D at lower doses of 10^{-3} affected germination percentage, the maximum like TIBA at the some concentration and therefore it can be concluded 2,4-D and TIBA at lower doses act as promoters of germination percentage and act as growth promoters than retardants. Similar findings were reported by (*Medhi et. al.2011*). Who reported that the growth regulators. TIBA at lower doses act as promoter's germination percentage as compared to other growth regulators.

Germination energy

It is revealed from table 1 that the maximum germination energy was observed by the varieties of mungbean (SML-668, K-851, P-9072 and Pant mung-5) treated with GA at doses 10^{-3},10^{-1},10^{-2} and 10^{-1} in 2012 and 10^{-1},10^{-1}, 10^{-3} and 10^{-2} in 2013 respectively. The similar trend was observed by all varieties treated with BA doses 10^{-3}, 10^{-1}, 10^{-3} and 10^{-1} in 2012 and 10^{-2}, 10^{-1}, 10^{-1}, 10^{-1} in 2013 respectably. The application of IAA with dose 10^{-2} as seed treatment showed the better response by P-9072 and Pant mung-5 in 2012 and 2013. All varieties showed dose 10^{-1} of TIBA and 2,4-D is superior irrespective of germination energy among all doses in 2012 and 2013. The results are in agreement with those obtained by (*Devi, et al. 2012*).

Plumule length

In Table 1 it was observed that there was a significant increasment was observed in plumule length over control in TIBA and 2, 4-D at dose 10^{-3} in all varieties in both the years. In case of variety, SML-668 and K-851 at par in all doses of GA and IAA over control. The 2, 4-D treatment was found superior than TIBA in variety Pant mung-5 and P-9072 in both experimental years. The results are in conformity with the findings of (*Al-Delaimy, A. O. A 2013*). This behavior of the growth regulators was consistent for all varieties in both the years. It is therefore, concluded that the plumule length was increasing maximum by 2,4-D and TIBA as compared to GA, IAA and BA in that order and all the varieties responded more or less the same way. Similar findings were reported by (*Algan et, al. 2011*).

Radicle length

The results presented in Table 1 the lowest dose 10^{-3} of GA was significantly better in increasing the radicle length (18.33, 18.00cm) in variety SML-668 and (19.70, 19.72cm) in variety K-851 as compared to IAA in both the years. In variety SML-668 and K-851, BA showed the least increase in radicle length at all the doses, as compared to all other growth regulators. In Pant mung -5 and P-9072 the dose of 10^{-1} of both GA and IAA significantly increased the radicle length. However, the dose of 10^{-3} was as good as control whereas the 10^{-1} dose of GA and IAA were significantly better than control. It can be concluded that the treatment with 2, 4-D and TIBA at the highest dose was as good as control whereas at dose of 10^{-3} was significantly better in increasing the radicle length. A significant increment was recorded in case of 2,4-D and TIBA dose 10^{-3} the radicle length of varieties SML-668 and K-851 over control in both years. The radicles were stouter, stronger and thicker than the control and both GA and IAA affected treatments. This aspect had a great bearing on the health of the plants that were in generally healthier when treated with 2.4-D and TIBA in case of K-851. These results are in conformity with the findings of (*Aldesuquy et, al. 2007*) who also reported increase in radicle length with increase in doses of treatments.

Vigor index

It was observed in Table 2 that each growth regulator induced significant changes in vigour index and that each dose also made significant impact dose at all intervals induced the highest vigor index as compared to any other growth regulator at any dose, followed by 2, 4-D, it was TIBA again at 10^{-3} that induced the highest vigor index between various doses of TIBA and 2,4-D, each dose induced a significant impact over the other dose 10^{-1} being the lowest. The impact of 2,4-D (10^{-3}) and TIBA (10^{-3}) was significantly better than the control where all other growth regulator and the corresponding doses were inferior to the control except GA (10^{-3}) in 2012 in variety K-851. In case of varieties Pant mung-5 and P-9072, the response to the doses was reversed in case of both GA and IAA because the dose or 10^{-1} increased the vigor index. Where in varieties K-851 and SML-668 the response was exactly opposite that is the vigor index in case of BA, TIBA and 2,4-D, increase with the decreasing doses. Similar results were reported

Table 1: Effect of growth regulators priming on seed germination, germination energy and some other traits in mungbean in years (2012 and 2013)

Variety	Growth Regulators	Doses	Germination % 2012	Germination % 2013	Germination energy 2012	Germination energy 2013	Plumule length (cm) 2012	Plumule length (cm) 2013	Radicle length (cm) 2012	Radicle length (cm) 2013
Pant mung-5	Control		65.3	55.3	400.0	817.0	17.3	18.6	15.9	15.6
	GA	10^1	55.3	53.3	1000	917.0	16.0	16.1	17.2	16.4
	GA	10^2	53.3	58.6	933.5	900.0	15.6	15.8	15.9	16.2
	GA	10^3	52.6	60.6	900.0	867.0	15.3	15.4	15.6	15.8
	BA	10^1	45.3	50.6	883.5	883.0	13.6	13.8	15.6	15.8
	BA	10^2	46.0	52.6	816.5	883.0	13.8	14.6	15.2	15.6
	BA	10^3	47.3	54.6	800.0	817.0	13.9	14.1	14.9	15.2
	IAA	10^1	51.3	52.6	833.0	867.0	14.8	14.9	17.1	16.2
	IAA	10^2	50.0	57.3	850.0	817.0	14.5	14.6	15.8	16.1
	IAA	10^3	49.3	59.3	833.5	816.0	14.1	14.7	15.5	15.7
	TIBA	10^1	54.6	55.3	933.5	850.0	16.9	17.0	12.3	13.7
	TIBA	10^2	58.0	58.6	866.5	850.0	16.9	17.0	12.4	13.5
	TIBA	10^3	63.3	60.6	867.0	833.5	17.4	15.5	12.6	13.1
	2,4-D	10^1	63.6	56.6	916.5	853.5	17.6	17.7	12.2	13.4
	2,4-D	10^2	56.3	59.3	850.0	817.0	17.9	18.1	12.3	13.6
	2,4-D	10^3	67.3	61.3	816.5	767.0	18.4	18.6	12.4	13.8
	CD at 5%		0.47	2.48	28.5	19.2	0.27	0.29	1.52	0.21
SML-668	Control		60.6	50.6	983.5	1083.5	17.6	17.7	18.2	17.7
	GA	10^1	55.3	45.3	1050.0	1150.0	17.5	17.6	18.2	17.6
	GA	10^2	58.0	43.3	1050.0	1117.0	17.6	17.7	18.2	17.7
	GA	10^3	60.0	41.3	1083.0	1165.0	17.7	17.7	18.3	17.7
	BA	10^1	50.0	38.0	933.5	1083.0	17.2	17.2	17.5	17.2
	BA	10^2	53.3	39.3	916.5	1067.0	17.3	18.4	17.6	18.4
	BA	10^3	55.3	41.3	983.0	1066.5	17.4	17.4	17.7	17.4
	IAA	10^1	57.3	44.6	1033.5	1133.0	17.3	17.3	18.0	17.3
	IAA	10^2	60.6	42.0	1033.5	1133.0	17.4	17.5	18.1	17.5
	IAA	10^3	62.0	40.6	1017.0	1100.0	17.5	17.6	18.2	17.6
	TIBA	10^1	58.0	45.3	1000.0	1200.0	17.5	17.6	18.3	17.6
	TIBA	10^2	61.3	46.0	1000.0	1167.0	17.7	17.2	18.3	17.2
	TIBA	10^3	97.3	48.6	900.0	1200.0	17.8	17.8	18.3	17.8
	2,4-D	10^1	96.6	50.6	983.5	1116.5	17.9	18.0	18.3	18.0
	2,4-D	10^2	97.3	51.3	1000.0	1150.0	18.1	18.2	18.4	18.2
	2,4-D	10^3	65.3	53.3	1016.5	1133.0	18.3	18.3	18.5	18.3
	CD at 5%		1.21	2.49	28.5	36.1	0.77	0.41	0.71	0.41
P-9072	Control		62.6	53.3	616.0	700.0	16.8	17.2	15.8	15.1
	GA	10^1	52.6	50.6	783.0	867.0	17.1	17.1	17.0	16.0
	GA	10^2	50.6	55.3	800.0	867.0	16.7	18.8	15.0	15.9
	GA	10^3	48.6	58.0	783.5	900.0	16.3	16.4	15.7	15.4
	BA	10^1	40.6	45.3	700.0	750.0	13.3	13.3	15.0	15.2
	BA	10^2	42.6	47.3	733.5	750.0	13.7	13.8	15.0	15.1
	BA	10^3	44.6	49.3	750.0	750.0	14.2	14.5	15.2	15.2
	IAA	10^1	49.3	48.0	716.5	833.0	14.6	14.6	17.1	16.2
	IAA	10^2	47.3	53.3	733.5	900.0	14.6	14.3	17.2	16.2
	IAA	10^3	46.0	57.3	700.0	866.5	13.5	13.6	17.0	16.1
	TIBA	10^1	55.3	55.3	767.0	833.0	17.2	17.4	13.0	14.1
	TIBA	10^2	56.6	57.3	733.5	850.0	17.4	18.0	13.4	14.4
	TIBA	10^3	58.6	59.3	666.5	817.0	18.2	18.3	13.5	14.6
	2,4-D	10^1	60.6	54.0	683.0	800.0	18.2	18.0	13.4	14.6
	2,4-D	10^2	63.3	58.0	666.5	750.0	18.5	18.8	13.4	14.4
	2,4-D	10^3	65.3	60.0	683.0	750.0	19.5	18.8	13.7	14.9
	CD at 5%		0.28	2.78	22.1	17.1	0.51	0.75	0.62	0.56
K-851	Control		62.6	46.6	1050.0	1033.0	19.5	14.7	20.2	20.3
	GA	10^1	58.6	40.6	1083.0	1050.0	19.2	19.3	19.5	19.6
	GA	10^2	60.0	38.6	1033.0	933.5	19.4	19.5	19.6	19.6
	GA	10^3	62.6	37.3	950.0	900.0	19.5	19.6	19.7	19.7
	BA	10^1	55.3	35.3	966.5	1000.0	18.8	18.8	18.9	18.9
	BA	10^2	60.6	36.6	950.0	967.0	18.9	19.0	19.2	19.2
	BA	10^3	60.6	38.0	950.0	967.0	19.1	19.1	19.3	19.3
	IAA	10^1	62.6	39.3	1133.5	1067.0	19.1	19.1	19.4	19.4
	IAA	10^2	63.3	37.3	1050.0	1000.0	19.3	19.4	19.4	19.5
	IAA	10^3	62.3	36.6	1000.0	950.0	19.5	19.5	19.5	19.5
	TIBA	10^1	63.3	40.6	933.0	1016.5	19.5	19.8	19.9	19.9
	TIBA	10^2	62.0	42.6	916.5	950.0	19.7	19.9	20.0	20.0
	TIBA	10^3	63.3	44.6	900.0	917.0	19.9	20.0	2.1	20.1
	2,4-D	10^1	64.6	45.3	1016.5	1000.0	19.7	19.9	20.2	20.5
	2,4-D	10^2	64.6	47.3	950.0	950.0	19.9	20.1	21.6	21.7
	2,4-D	10^3	66.6	49.3	933.5	916.5	20.1	20.3	21.8	21.9
	CD at 5%		2.41	2.02	2.41	34.7	0.62	0.38	0.72	0.11

Table 2: Effect of growth regulators priming on plant height, number of seeds per pod and some other traits in mungbean in years (2012 and 2013)

Variety	Growth Regulators	Doses	Vigor index 2012	Vigor index 2013	Plant height (cm) 2012	Plant height (cm) 2013	No. of seeds per pod 2012	No. of seeds per pod 2013	100 seed weight (g) 2012	100 seed weight (g) 2013
Pant	Control		1516.5	1904.2	62.6	61.6	12.0	13.0	4.2	4.5
mung-5	GA	10^1	1481.8	1897.4	67.0	71.0	12.3	13.3	4.9	4.4
	GA	10^2	1425.1	1873.9	64.6	66.7	12.0	13.3	4.8	4.3
	GA	10^3	1371.7	1840.0	63.6	64.7	12.0	13.3	4.7	4.2
	BA	10^1	975.4	1709.8	70.3	76.3	12.6	13.7	4.3	4.9
	BA	10^2	1037.4	1735.4	68.8	72.8	12.3	13.3	4.2	4.7
	BA	10^3	1098.2	1791.1	66.6	69.7	12.0	13.0	4.0	4.0
	IAA	10^1	1173.6	1900.0	66.8	68.2	12.6	13.7	4.7	4.6
	IAA	10^2	1116.3	1888.4	65.3	67.4	12.3	13.3	4.5	4.5
	IAA	10^3	1046.4	1824.8	63.6	63.4	11.6	12.7	4.4	4.4
	TIBA	10^1	1470.4	1904.8	54.5	55.8	11.6	12.7	5.0	5.0
	TIBA	10^2	1519.7	1928.3	60.4	57.1	12.0	13.0	5.2	5.2
	TIBA	10^3	1640.7	1951.6	61.4	58.4	12.3	13.3	5.6	5.4
	2,4-D	10^1	1650.0	1931.2	58.9	53.9	11.6	12.7	5.0	4.8
	2,4-D	10^2	1702.0	1961.4	61.7	54.7	12.0	13.0	5.2	5.2
	2,4-D	10^3	1848.7	1994.3	62.6	60.6	12.3	13.4	5.4	5.7
	CD at 5%		28.5	38.4	2.77	2.33	0.94	0.94	0.06	0.37
SML-668	Control		1706.0	1557.0	32.6	34.7	10.2	11.3	5.2	5.4
	GA	10^1	1671.3	1397.4	44.8	51.8	10.3	11.4	5.6	5.8
	GA	10^2	1681.8	1335.5	42.8	50.8	10.0	11.1	5.2	5.2
	GA	10^3	1702.0	1295.3	39.3	42.3	9.9	11.0	4.9	4.8
	BA	10^1	1467.8	1029.4	41.0	48.0	9.7	10.8	4.2	4.7
	BA	10^2	1491.2	1051.0	38.4	41.4	9.6	10.7	4.0	4.3
	BA	10^3	1519.7	1125.2	30.2	31.2	9.5	10.6	3.8	4.0
	IAA	10^1	1568.4	1272.8	48.6	53.6	10.4	11.5	5.8	5.9
	IAA	10^2	1649.9	1208.4	40.4	44.4	10.0	11.1	5.0	5.0
	IAA	10^3	1673.2	1150.9	36.1	40.1	9.8	10.9	4.8	4.7
	TIBA	10^1	1673.2	1442.2	28.1	30.1	10.0	11.3	4.9	4.9
	TIBA	10^2	1703.0	1453.4	27.1	28.2	10.3	11.4	5.3	5.4
	TIBA	10^3	1732.6	1477.3	34.5	36.6	10.8	11.9	5.8	5.7
	2,4-D	10^1	1732.0	1588.5	25.1	26.2	10.3	11.4	5.0	5.0
	2,4-D	10^2	1766.7	1634.9	35.1	38.2	10.7	11.8	5.2	5.5
	2,4-D	10^3	1793.4	1729.6	31.9	33.9	10.9	12.0	5.4	5.8
	CD at 5%		33.9	37.8	2.72	2.02	0.91	0.91	0.06	0.24
P-9072	Control		1559.3	1859.1	58.3	58.3	12.3	13.4	4.5	4.4
	GA	10^1	1495.2	1876.8	60.7	62.7	13.0	14.0	4.4	4.5
	GA	10^2	1433.7	1880.0	60.0	61.1	12.6	13.7	4.3	4.4
	GA	10^3	1394.3	1809.5	59.1	60.1	12.3	13.4	4.1	4.3
	BA	10^1	941.9	1579.2	65.1	68.1	12.6	13.7	4.9	5.0
	BA	10^2	1002.7	1617.1	63.7	67.7	11.6	12.7	4.7	4.8
	BA	10^3	1084.8	1672.5	61.5	63.5	11.3	12.4	4.2	4.6
	IAA	10^1	1242.8	1898.1	62.1	65.2	13.0	14.0	4.5	4.5
	IAA	10^2	1197.6	1844.8	61.0	59.0	12.3	13.4	4.3	4.4
	IAA	10^3	1099.4	1782.7	57.6	56.7	11.6	12.7	4.2	4.3
	TIBA	10^1	1542.6	1811.5	52.5	52.5	12.0	13.0	5.0	5.0
	TIBA	10^2	1631.8	1851.8	54.5	53.5	12.3	13.4	5.2	5.7
	TIBA	10^3	1671.2	1897.2	56.1	54.1	12.6	13.7	5.4	5.9
	2,4-D	10^1	1674.3	1869.9	45.7	48.7	12.0	13.0	4.6	4.9
	2,4-D	10^2	1754.7	1915.2	48.6	50.6	12.6	13.7	5.2	5.2
	2,4-D	10^3	1799.0	1956.5	49.3	51.3	13.0	14.0	5.3	5.8
	CD at 5%		34.7	37.3	2.89	2.33	0.92	0.92	0.05	0.24
K-851	Control		1741.8	1624.5	45.4	51.4	11.2	12.3	4.3	5.0
	GA	10^1	1700.8	1399.5	63.2	67.3	12.7	13.2	5.3	5.3
	GA	10^2	1721.2	1320.9	60.2	64.3	11.8	12.9	5.0	5.1
	GA	10^3	1752.1	1266.9	54.1	56.2	11.4	12.4	4.7	5.0
	BA	10^1	1582.0	1089.4	58.3	60.4	11.4	12.5	4.8	5.0
	BA	10^2	1619.7	1114.7	61.5	64.5	11.2	12.3	4.4	4.6
	BA	10^3	1637.1	1141.3	49.1	54.2	11.3	12.2	4.1	4.1
	IAA	10^1	1682.7	1265.6	42.5	49.6	12.0	13.1	5.4	5.4
	IAA	10^2	1689.4	1210.9	40.6	43.7	11.2	12.3	4.9	5.3
	IAA	10^3	1706.8	1157.4	39.7	43.7	11.0	12.0	4.2	5.1
	TIBA	10^1	1737.6	1507.2	37.1	37.1	11.8	12.8	4.4	4.9
	TIBA	10^2	1766.7	1518.7	38.2	40.3	12.6	13.7	4.8	5.4
	TIBA	10^3	1786.5	1636.2	36.4	34.4	12.8	13.8	5.2	5.7
	2,4-D	10^1	1791.4	1597.5	37.0	36.0	11.9	12.9	4.6	5.0
	2,4-D	10^2	1818.9	1694.1	38.0	39.1	12.7	13.8	4.9	5.4
	2,4-D	10^3	1822.8	1767.3	38.4	42.5	12.9	13.9	5.1	5.6
	CD at 5%		26.4	28.3	4.86	4.79	0.87	0.86	0.04	0.24

by (*Ali et al. 2008*) who found that the plants would be vigorous and healthy which are obtained after the pre sowing seed treatment with 2,4-D and TIBA at lower doses.

Plant height

The data given in table 2 revealed that varieties P-9072 and Pant mung-5, plant height was increased maximum and significantly by BA at 10^{-1} dose. However the difference between GA, IAA and BA at 10^{-1} dose in increasing the plant height was significantly indicating thereby that the effect of all the doses was not similar. Some was the case for the other doses also. Infact 2,4-D and TIBA in variety Pant mung-5 also significantly decreased the plant height as compared to control or other growth regulator in both the years. The response of varieties Pant mung-5 and P-9072 was different than the varieties K-851 and SML-668 as there was significantly increase or decrease in both the years. In both the varieties SML-668 and K-851 at doses (control, 10^{-1},10^{-2},10^{-3}) and with all the growth regulators. GA and IAA at all doses significantly increased the plant height whereas TIBA and 2,4-D decreased the plant height significantly. Maximum decrease was induced by the 10^{-1} dose of both height minimum as compared to the other dose of the same growth regulators. BA at 10^{-1} dose increased the plant height significantly as compared to control and the other doses. These results confirm the findings of (*Devi et, al. 2012*).

Number of seeds pod^{-1}

The results concerning number of seeds pod^{-1} in four varieties of mungbean and all growth regulators, presented in table -2 mungbean varieties of K-851 and SML-668, TIBA and 2,4-D induced a significant increase in number of seeds pod^{-1} at dose (10^{-3}) whereas GA and IAA gave the same result at higher dose (10^{-3}). However the increase affected by TIBA and 2,4-D was significantly better than GA and IAA. The highest increase (13.97g) was found in 2013 at 10^{-3} in case of 2,4-D in general, the role of BA was similar to the higher dose of both TIBA and 2,4-D and the lower concentrations of both GA and IAA. In case of varieties Pant mung-5 and P-9072 the number of seeds pod^{-1} were better as compared to K-851 and SML-668. Each growth regulator, their doses and the interactions between the growth regulator and dose showed their significant impact on the number on seeds pod^{-1}, meaning thereby, that Pant mung-5 and P-9072 responded better than the K-851 and SML-668 in all the tested varieties, dose at 10^{-1} of GA and IAA and dose at 10^{-3} of TIBA and 2,4-D induced more number of seeds as compared to other doses. These results are in full agreement with those observations by (*Srimathi.et al. 2006*).

100 seed weight

The data given in table 2 revealed that the varieties K-851 and SML-668, there was significant impact of the growth regulators GA and IAA at dose of 10^{-1}, and TIBA and 2,4-D at 10^{-3} for inducing better 100 seed weight as compared to control. BA at all the doses of 10^{-3} had lower 100 seed weight as compared to control. Maximum 100 seed weight was noticed at all the doses of 2,4-D. The response of P-9072 was considerable better than the variety K-851 as in general the 100 seed weight was better. Even the response of BA at 10^{-1} and 10^{-2} doses was significantly better than the control in Pant mung-5 and P-9072 whereas such response was not observed in the varieties K-851 and SML-668. However, the maximum increase in 100 seed weight was induced by 2,4-D and TIBA.

References

Al-Delaimy, A. O. A (2013). Effect of mineral acids on rooting response of aging mung bean (Phaseolus aureus Roxb.) cuttings via indole acetic acid level. *Journal of Agricultural Science and Technology* : 3(6):455-464.

Aldesuquy, H. S. El-Shahaby, O. A. Sadeek, A. M.(2007). Water relations and growth vigour of Vigna sinensis plants in relation to indole acetic acid, gibberellic acid or kinetin. *Acta Botanica Hungarica*; 49(3/4):251-265.

Algan N and Çelen A E (2011). Evaluation of mung bean (*Vigna radiata* L.) as green manure in Aegean conditions in terms of soil nutrition under different sowing dates. *African J Agric Res* 6:1744-49.

Ali, B. Hayat, S. Hasan, S. A. Ahmad, A. (2008). IAA and 4-Cl-IAA increases the growth and nitrogen fixation in mung bean. *Communications in Soil Science and Plant Analysis:* 39(17/18):2695-2705.

Cochran, W.G. and Cox, G.M. (1967). Experimental Designs. IInd Ed. John Wiley and Sons, Inc. New York.

Devi, R. G. Pandiyarajan, V. Gurusaravanan, P. (2012). Alleviating effect of IAA on salt stressed *Phaseolus mungo* (L.) with reference to growth and biochemical characteristics. *Recent Research in Science and Technology*;. 4(3):22-24.

Medhi, A. K. Roy, A. (2011). Effect of foliar application of growth regulators on growth physiology, quality and yield in greengram [*Vigna radiata* (L.) Wilczek] var. PDM-54. *Research on Crops*;. 12(2):425-428.

Medhi, A. K. Sudip Dhar Majumder, T. K.(2005). Effect of bioregulators on physio-morphological features in early seedlings of *Vigna radiata* L. Wilczek var PDM-54. *Environment and Ecology*;. 23S (Special 3):513-516.

Srimathi, P. Sujatha, K.(2006). Chemical priming for improved seed yield and quality in blackgram (*Vigna mungo* (L.) Hepper) var. CO 5. *Plant Archives*;. 6(1):177-180.

Watson, D.J. (1952). The physiological basis of variation in yield. *Adv. Agron.,* 4: 101-145.