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Research Article

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Effect of Topographical Features on the Growth and Yield of the Leaves of *Sesbania Grandiflora* L. Pers of Gunjur Region, Chikkaballapur District, Karnataka.

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Abstract: The leaves of *Sesbania grandiflora* L. Pers were collected from the Gunjur region of Chikkaballapur district and subjected to analysis for checking the growth. The data of the area regarding height in terms of growth, texture determining the soil type, rainfall occurred during the study duration, numbers of leaves per plant were recorded for quarterly analysis viz., March, June, September, and December 2020. The average yield was estimated according to the total number of plots of land utilized for cultivation. The phytochemicals present in these samples were evaluated for their presence. Overall features affecting the growth and yield were interpreted based on the survey. The present study focuses on the consistancy of the yield of the leaves of the plant *Sesbania grandiflora* L. Pers irrespective of the changes in the topography of Gunjur region, Chikkaballapur district, Karnataka State.

Keywords: *Sesbania grandiflora* L. Pers**,** quarterly analysis, average yield, cultivation, phytochemicals.

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1. INTRODUCTION

Sesbania grandiflora L. Pers is categorized under the family: Fabaceae. Its known as a common hedge plant, Swamp pea in English., Agast, Basna, Haddga in Hindi, Agastyah (Sanskrit), Agase mara (Kannada), Agatti (Malayalam), Attikiraj (Tamil) and Avasinara (Telugu). *Sesbania grandiflora*, L. Pers [2], West Indian pea, agati, or katurai, is a small tree in the genus *Sesbania* in the legume family. It has edible flowers and leaves commonly eaten in the Southeast Asia and South Asia.[3] An ephemeral, burgeon, topiary tree, 6 to 9 m in height, circumference 0.6 m, 17 to 35 cm long, precipitously pinnate, leaflets measure about 40 – 60, precarious- ovoid, evanescent; flowers are 6 to 10 cm long ostentatious, corpulent white, pink or red petals, 30 cm elongated pods, preferably flat and moderately quadrate, ellipsoid, distended margin with partition and seeds pale coloured with 15 – 50 in number[1]. A domesticated small tree commonly cultivated in beetle-vine plantations and gardens dispersed all over transitory forests, It can be cultivated in gardens and betel-vine plantations distributed throughout India. Western Ghats, dry deciduous forests and scrub jungle in Maharashtra (Mahabaleshwar hills, Kolhapur) and Karnataka (Tumkur, Hassan, Udupi, Ramanagaram and Mysore)[1]. Western dockside and dry chapparal regions of Karnataka viz., Bangalore rural, Chikkaballapura, Hassan, Kolar, Mysuru, Ramanagara and Tumakuru. It can be propagated by using seeds. The roots, bark, leaves, flowers and Fruits of *Sesbania grandiflora* L. Pers are of medicinal importance. It can be disseminated by utilizing the seeds. *Sesbania grandiflora* L. Pers fruits, flowers and leaves are of chief importance. The leaves are aperient, tart, treacly, purgative, analeptic, diuretic and possess saponin, non-poison substance. Several disorders like nasal sputum, visual impairment, migraine by consumption of the leaf extract. Cleansing of the mouth and throat is feasible by mastication of leaves, also cures stomachodynia[1]. The chemical constituents are alanine, arginine, asparagine, aspartic acid, cystine, galactose, glucuronic acid, grandifloral, histidine, isoleucine, phenylalanine, rhamnose, saponin yielding oleanolic acid, threonine, tryptophan and valine. The root-bark of the red-flowered variety is used to cure the vitiated conditions of vata and arthralgia. The bark is anti-helminthic, astringent, bitter, cooling, febrifuge and tonic. Scabies can be cured by the application of the pounded bark. The juice of the bark is good for treating diarrhoea, dyspepsia and gastralgia. The leaves are acrid, aperient, bitter, cooling, diuretic, sweet, tonic and contain a non-poisonous saponin-like substance. The leaf juice is used in cephalagia, nasal catarrh and nyctalopia. Leaves are chewed to disinfect mouth and throat and are useful in treating stomachalgia. The flowers possess a cooling effect, bitter and act as an astringent, acrid and anti-pyretic. The appliaction of the Flower extract to the eyes cures nyctalopia and used in treating intermittent fevers. The fruits are sweet and bitter, alexiteric as wel as laxative, also are useful as colic-inflatulant, these fruits can also cure anemia, emaciation and vitiated conditions of tridosa[1]. The *Sesbania grandiflora* L. Pers flowers and young leaves of are edible and are often used to supplement meals and ripe pods are not consumed., however the tender pods are used as vegetables. In some countries, the decoction of the dried leaves of *Sesbania grandiflora* L. Pers are used as a tea possess anti-biotic, anthelmintic [4, 5, 6] and anti–tumor [4].

2. MATERIALS AND METHODS

The leaves of *Sesbania grandiflora* L. Pers were collected from Gunjur, Chikkaballapur district, Karnataka during the year 2020 at regular interval of 3 months., viz., March, June, September, and December. The nature of growth of the plant, morphological studies and the yield of leaves were recorded and tabulated. The soil profile was also determined viz., nature of pH, conductivity, water holding capacity along with the measurement of height of the plant, weight and length of the leaves.

2.1 Protocols Followed For Phytochemical Analysis

2.1.1 Test for Phlobatannins[11,13]

5 ml of the plant extract was dissolved in distil water in a test tube, shaken well and filtered. To this plant extract, 1% aqueous hydrochloric acid(1% Aq.HCl) was added and boiled in a Hot water bath. Formation of red colored precipitate confirmed a positive result and indicated the presence of Phlobotannins[11, 13].

2.1.2 Test for Reducing Sugar[11]

5 ml of plant extract was added in 5 ml of distilled water along with 1 ml ethanol, to this mixture, 1 ml each of Fehling solution A and B was added in a test tube and heated to boil, later it was transfered into the aqueous ethanol extract. The color reaction observed revealed a positive result that indicated the presence of reducing sugar[11].

2.1.3 Test for Terpenoids[11]

8 ml of plant powder was taken in a test tube, then add 10 ml of methanol in it, shake well and filter to take about 5 ml extract of plant extract. To this mixture, 2 ml Chloroform was added. Slowly 3ml of Sulphuric acid was added to this plant extract. Formation of reddish brown color indicated the presence of terpenoids[11].

2.1.4 Test for flavonoids[11]

5 ml of each plant extract was poured into a test tube containing 10 ml of distilled water and 5 ml of dilute ammonia solution to a portion of the aqueous filtrate of each plant extract. Later 1 ml concentrated Sulphuric acid (1ml Conc. H_2S0_4) was added. The presence of yellow color indicated the presence of flavonoid in each extract[11].

2.1.5 Test for alkaloids[11]

2 ml of the plant powder was taken in a test tube, 3 ml of hexane was added, shaken well and filtered. Then 5 ml of 2% HCl was added into the test tube containing the mixture of plant extract and hexane. Later this mixture was heated, filtered and a few drops of picric acid was added into this mixture. Formation of yellow color precipitate indicated the presence of alkaloids[11].

2.1.6 Test for Tannins[13]

2ml of plant extract was added to 2ml of distil water along with 2-3 drops of 5% Ferric Chloride(Fe Cl_3). A formation of the green colored precipitate indicated the presence of tannins[13].

01: pH

Table :01: pH of the soil samples.			
pH of the soil samples	**Trial number 01**	**Trial number 02**	**Trial number 03**
March 2020	4.4	4.2	4.5
June 2020	4.7	4.6	4.8
September 2020	5.3	5.2	5.3
December 2020	5.7	5.8	5.6

02: *Conductivity*

Table:02: Conductivity of the soil samples			
Conductivity of the soil samples (in µS/cm)	Trial number 01	Trial number 02	Trial number 03
March 2020	20.7	15.6	14.5
June 2020	18.9	17.6	13.2
September 2020	21.3	18.2	17.6
December 2020	23.5	16.8	15.8

03: *Water Holding Capacity*

Table: 03: Water holding capacity of the soil samples.			
Water holding capacity of the soil samples (in %)	Trial number 10	Trial number 02	Trial number 03
March 2020	70.5	72.0	71.5
June 2020	61.9	62.8	60.6
September 2020	81.3	83.2	82.5
December 2020	80.0	78.8	79.7

04: *Morphological Studies*

10 sets of 10 plants selected for each row. the average height and weight was recorded at an interval of 10-11 days as trial no: 1, 2 and 3 for March, June, September, and December 2020.

Table no: 04: Height of the plants recorded at Gunjur region for 3 intervals in quarterly analysis in the year 2020.

Test plants period	Time	1st set	2nd set	3rd set	4th set	5th set	6th set	7th set	8th set	9th set	10th set
		Height of the plants (in cms)									
March 2020	1st trial	175.2	177.0	181.5	172.5	176.0	182.5	173.0	177.3	175.0	174.5
	2nd trial	176.0	177.5	182.0	173.8	177.0	183.0	174.4	178.5	178.0	176.0
	3rd trial	176.9	178.0	182.0	175.6	177.5	184.5	175.5	179.0	178.5	176.5
June 2020	1st trial	179.5	178.3	183.5	179.0	180.3	185.5	176.9	181.4	179.5	177.5
	2nd trial	180.2	179.5	184.8	180.5	181.9	186.0	179.0	182.5	180.5	178.6
	3rd trial	182.0	181.6	185.7	181.0	182.0	186.5	180.5	183.0	181.0	179.0
September 2020	1st trial	182.5	182.5	186.0	184.5	183.4	187.0	180.5	183.5	181.7	180.5
	2nd trial	183.0	184.8	187.2	185.8	184.9	188.2	181.4	184.9	183.5	182.4
	3rd trial	184.8	186.7	188.9	186.9	187.0	190.0	183.0	186.3	185.0	183.7
December 2020	1st trial	187.0	187.7	190.5	187.9	188.4	192.6	185.3	187.0	186.5	185.9
	2nd trial	189.4	188.5	191.8	188.6	189.3	193.3	194.6	189.2	189.7	187.5
	3rd trial	190.2	190.4	192.5	190.7	191.0	194.7	195.3	191.6	192.4	190.5

Table no: 05: Weight of the leaves collected from each plant recorded at Gunjur region for 3 intervals in quarterly analysis in the year 2020.

Test plants Time period		1st set	2nd set	3rd set	4th set	5th set	6th set	7th set	8th set	9th set	10th set
		Weight of the leaves per plant set (set of10 plants in a row) (weight measured in Kgs)									
March 2020	1st trial	14.5	17.8	22.4	16.7	15.4	20.0	14.8	17.0	15.5	16.8
	2nd trial	14.0	20.0	23.5	18.5	16.0	17.5	22.0	15.0	17.5	18.0
	3rd trial	16.0	22.5	22.0	20.0	17.0	18.0	17.0	18.5	15.0	19.0
June 2020	1st trial	20.0	17.0	19.0	22.6	17.5	20.0	20.5	21.0	18.0	19.5
	2nd trial	21.5	19.0	18.5	24.0	18.0	21.0	22.0	25.0	20.5	20.3
	3rd trial	22.5	21.0	20.0	25.5	16.8	18.5	21.0	24.5	21.0	23.0
September 2020	1st trial	25.0	23.5	21.8	26.0	18.5	19.5	22.7	27.0	22.5	25.7
	2nd trial	25.5	25.0	24.0	27.5	20.0	21.0	23.0	28.0	24.0	26.0

	3rd trial	26.0	26.5	26.0	28.0	22.5	23.0	24.4	29.2	25.8	27.5
December 2020	1st trial	25.0	27.9	28.5	29.0	24.7	25.5	26.9	30.5	28.0	30.2
	2nd trial	28.6	30.4	30.0	32.5	25.8	26.5	27.6	31.0	32.9	32.5
	3rd trial	30.0	31.5	31.0	34.5	28.0	29.5	29.0	34.0	33.0	35.5

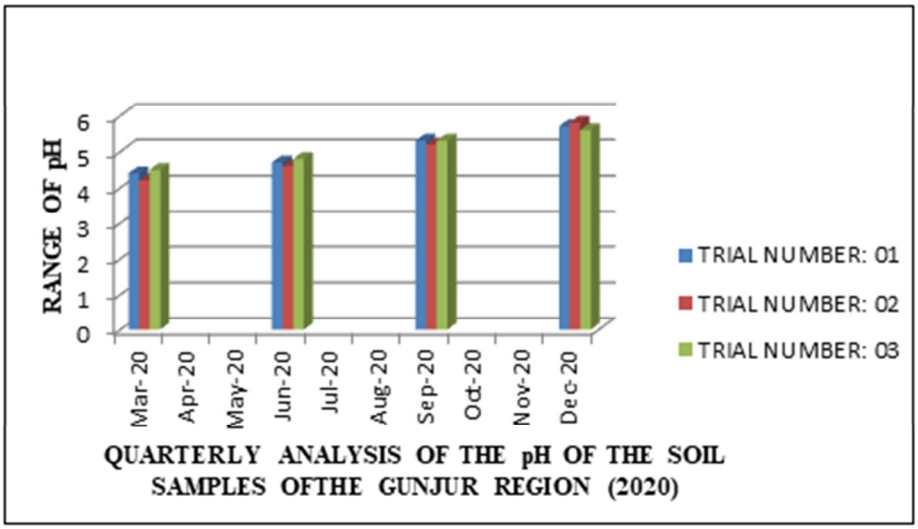
Table no: 06: Length of the compound leaves collected from each plant recorded at Gunjur for 3 intervals in quarterly analysis in the year 2020.

Test plants Time period		1st set	2nd set	3rd set	4th set	5th set	6th set	7th set	8th set	9th set	10th set
		Length of the compound leaves per plant (set of10 plants in a row) (length measured in cms)									
March 2020	1st trial	16.0	16.2	16.5	16.3	17.0	16.5	17.2	17.5	17.8	16.4
	2nd trial	17.5	17.9	17.0	17.0	18.6	17.0	18.2	18.0	18.6	17.7
	3rd trial	18.9	18.6	18.5	18.0	19.3	18.2	19.5	19.3	19.7	18.5
June 2020	1st trial	19.3	19.3	19.5	19.7	20.0	19.0	20.0	20.0	20.0	19.6
	2nd trial	20.5	20.3	20.7	20.9	21.9	20.7	21.3	21.8	21.5	20.3
	3rd trial	21.0	21.7	21.4	21.9	22.6	21.5	22.7	22.2	22.9	21.7
September 2020	1st trial	22.7	22.9	22.3	22.5	23.5	22.9	23.9	23.5	23.8	22.6
	2nd trial	24.0	23.8	24.5	24.7	24.9	24.0	24.7	24.4	24.9	23.8
	3rd trial	25.5	25.0	25.5	25.7	25.4	25.9	25.4	25.8	25.2	25.0
December 2020	1st trial	25.0	25.3	25.6	25.9	25.5	26.0	26.0	26.3	26.1	26.0
	2nd trial	24.5	23.8	22.0	24.5	21.9	23.8	21.0	22.7	24.8	23.3
	3rd trial	21.0	22.0	21.3	22.9	20.0	21.8	22.5	23.7	22.0	21.5

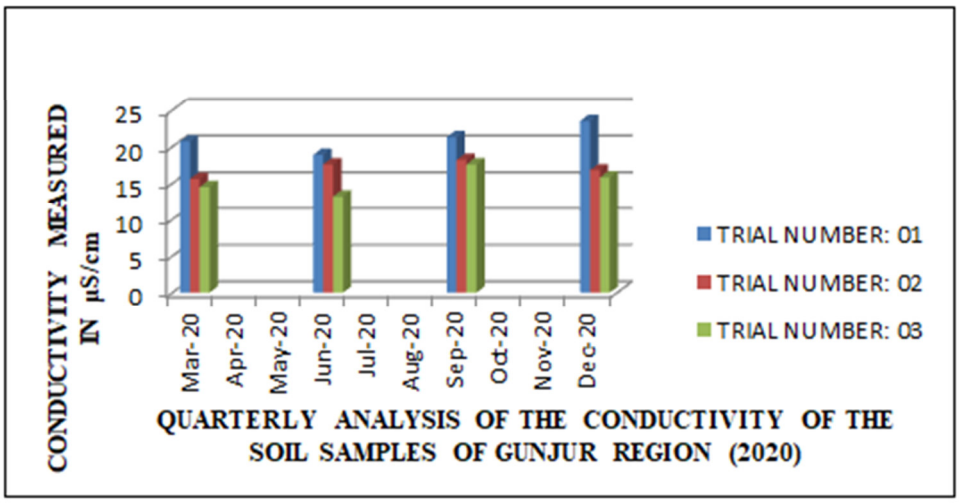
Table no: 07: Phytochemical screening of the leaf powder (hot and cold extraction method) collected from plants recorded at Gunjur for 3 intervals in quarterly analysis in the year 2020.

Time period		Phlobatannins		Reducing sugars		Terpenoids		Flavonoids		Alkaloids		Tannins	
March 2020	Extraction method in Methanol	Hot	Cold	Hot	Cold	Hot	Cold	Hot	Cold	Hot	Cold	Hot	Cold
	1st trial	+	+	-	+	-	+	-	+	+	+	+	+
	2nd trial	+	+	-	+	-	+	-	+	+	+	+	+
	3rd trial	+	+	-	+	-	+	-	+	+	+	+	+
June 2020	1st trial	-	+	-	+	-	+	-	+	+	+	+	+
	2nd trial	-	+	-	+	-	+	-	+	+	+	+	+
	3rd trial	-	+	-	+	-	+	-	+	+	+	+	+
September 2020	1st trial	-	+	-	+	-	+	-	+	+	+	+	+
	2nd trial	-	+	-	+	-	+	-	+	+	+	+	+
	3rd trial	-	+	-	+	-	+	-	+	+	+	+	+
December 2020	1st trial	+	+	-	+	-	+	-	+	+	+	-	+
	2nd trial	+	+	-	+	-	+	-	+	+	+	-	+
	3rd trial	+	+	-	+	-	+	-	+	+	+	-	+

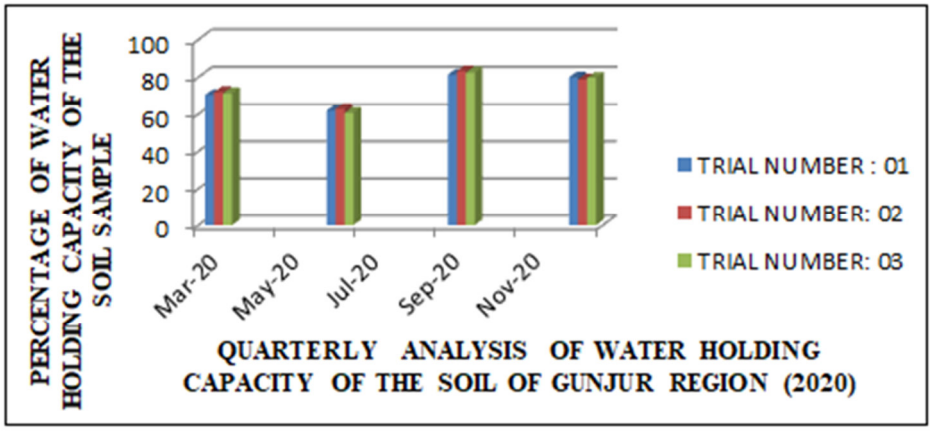
05: *Graphical Representation*



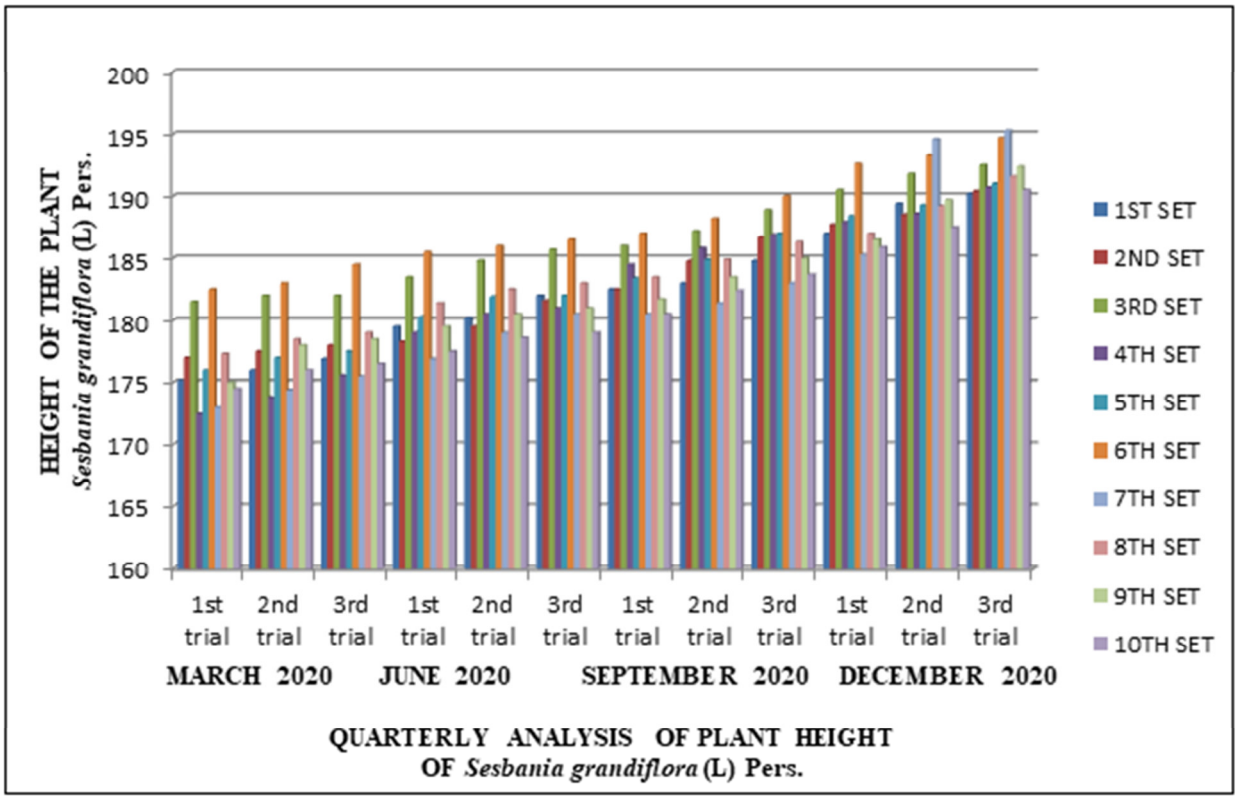
Graph : 01: pH of the soil sample - Gunjur region (2020)



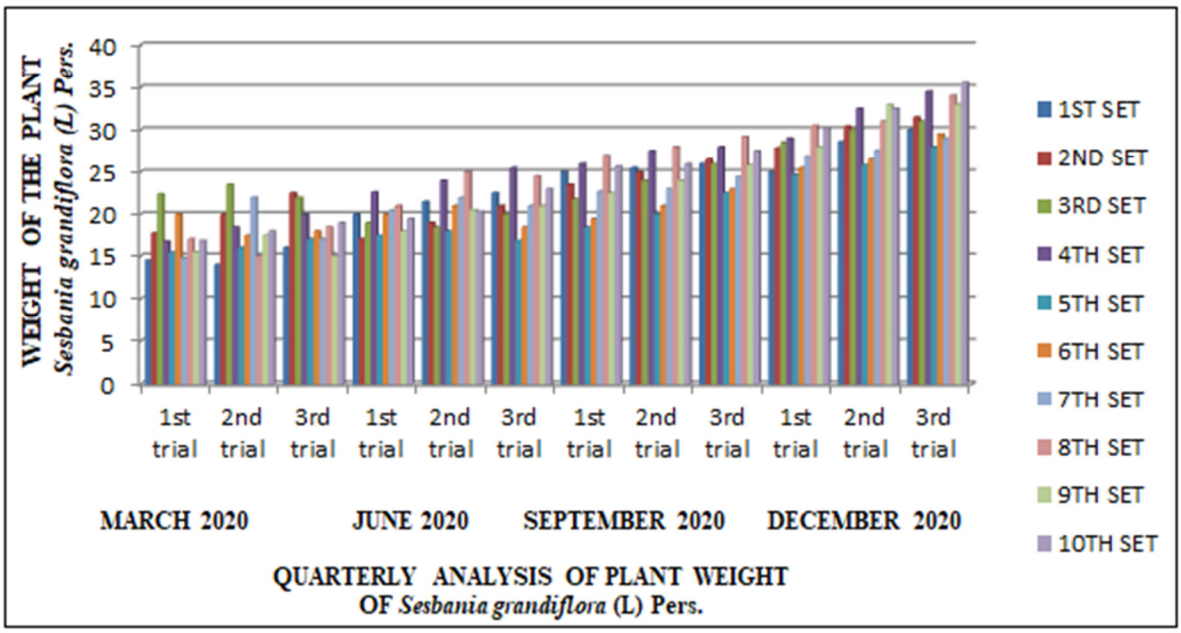
Graph : 02: Conductivity of the soil sample - Gunjur region (2020)



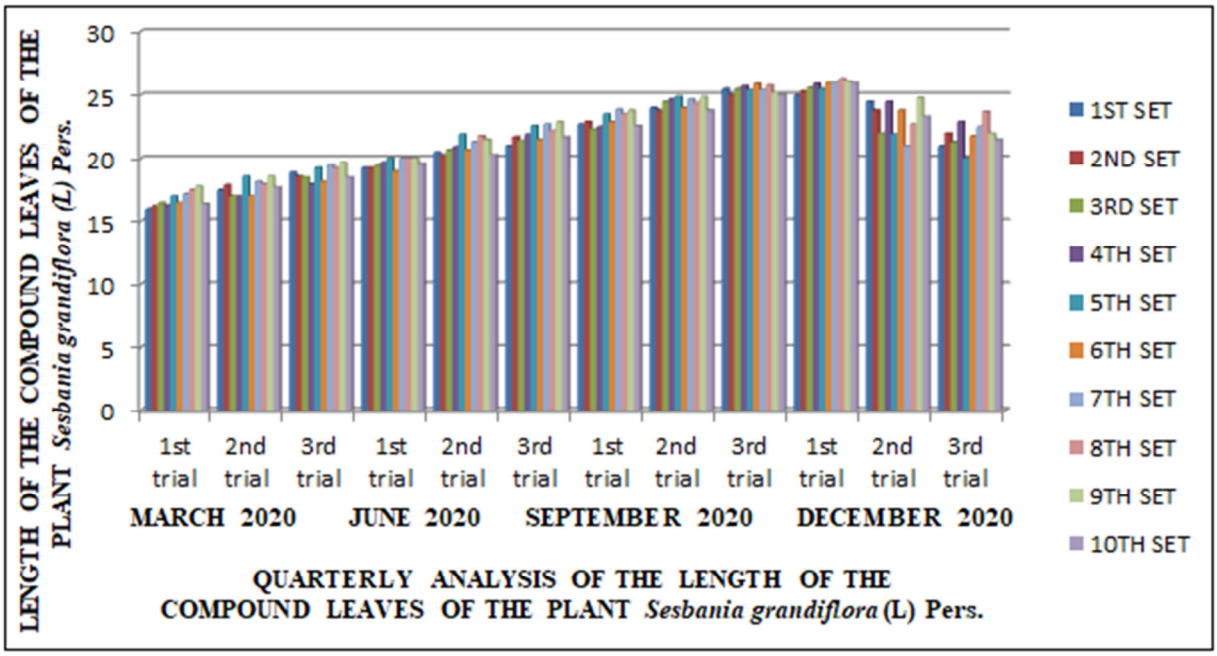
Graph : 03: Water holding capacity of the soil sample - Gunjur region (2020)



Graph: 04: Height of the plants recorded– Gunjur region (2020)



Graph: 05: Weight of the plants recorded – Gunjur region (2020)



Graph: 06: Length of the compound leaves of the plants recorded-Gunjur region(2020)

Photographs

Fig:1 and 2. Gunjur Region : *Sesbania Grandiflora* L. Pers Collection Area.

Fig: 3: Habit of *Sesbania grandiflora* L. Pers

Fig: 4: Length of leaf recorded: Gunjur region.

3. RESULTS

The changes in the soil profile increased growth rate of the plant with drastic changes in height viz., 176.4 to 178.4 cms (March)., 180.14 to 182.23 cms (June)., 183.21 to 186.23 cms (September)., and 187.88 to 191.93 cms (December) 2020 (Table: 04)(Graph:04) . The soil replenished the yield viz., total weight of the leaves per plant increased quarterly in the year 2020., 17.09 to 18.5kgs (March)., 19.51 to 21.38 kgs (June)., 23.22 to 25.89 kgs (September)., and 27.62 to 31.6 kgs (December) (Table: 05)(Graph:05). By the graphical observations and analysis of the yield., we can conclude that the low growth rate prevailed in high acidic nature (pH : 4.2) (Table : 01) (Graph: 01) of the soil and less acidic nature (pH : 5.8) (Table: 01)(Graph: 01) initiated more yield. The yield was limited due to low conductivity of water in the soil, 178.4µS/cm but surged upto 23.5 µS/cm (Table: 02) (Graph: 02). In addition to this even the water holding capacity also contributed for the fulfledged growth of the plant viz., highest (82.5%) (Table:03) (Graph: 03) in september (Rainy season) but was relatively lesser (viz., 60.6%) (Table:03) (Graph: 03) during June 2020 (Pre-monsoon). The length of the compound leaves recorded (Fig: 04) were also higher in case of.26.3 in December 2020(Table: 06)(Graph: 06)., which proved to be best season for high yeild of the leaves of *Sesbania grandiflora* L. Pers., whereas in rainy season the growth was retarded with 25.9 (Table: 06)(Graph: 06). The presence of Phlobotannins in the March and December 2020 (Table: 07), indicated during summer and winter seasons the components were intact in the tissues, through hot decoction method, there was subsequent absence in the samples collected during rainy season. Unlike, the same was not a constraint in case of tannins, which exhibited absence by hot decoction method during winter season (December 2020)(Table:07). The rest of the phytochemicals viz., reducing sugars, terpenoids, flavonoids confirmed its absence through hot decoction method in all seasons that remained consistant all thtrough the year 2020. Overall comparative studies revealed that all the topographical features irrespective of minor differences contribute to the high yield of the leaves of the *Sesbania grandiflora* L. Pers.

4. DISCUSSION

Apparently, the quantitative access was carried out in terms of yield of the leaves of *Sesbania grandiflora* L. Pers. in the present study. A consistent study of all the features relating to the growth affirmed the physical factors viz., nature, conductivity and water holding capacity of the soil influenced the growth and yield. *Sesbania grandiflora* L. Pers grown along the lanes of the grass species., viz., *Panicum maximum* cv. proved to be effective in production of highest yield of dry weight thicket grass[7]. The leaves of *Sesbania aculeata* L. Pers were used as an additive for Damascus Doe (Female sheep).and that it adversely affected the reproductive capacities whereas the effect was quiet different in other ruminants belonging to Syria and Damascus[8]. The medicinal properties of *Sesbania grandiflora* L. Pers viz., ethanolic extract were efficacious as an remarkable constrained gastric sputum damage pursuaded by aspirin, indomethacin and ethanol and induction of 400mg/kg dosage formed a notable depletion in ulcer lead[9]. *Sesbania grandiflora* L. Pers was tested for the anti-microbial activity of nano-sized leaf powder and also the qualitative phytocompounds were screened which revealed the presence of Alkaloids, Anthraquinones, Carbohydrates, Flavonoids, Glycosides, Pholobatannins, Proteins, Steroids, Tannins and Terpenoids. The results obtained depicted that uniform size as compared to Crude leaf powder was very potent due to its particle size and in addition to this, it was found that the high ability to kill microbes was because of the nano-sized leaf powder[10]. The ethanolic extract of the *Sesbania grandiflora* L. Pers. leaves exhibited high anti-bacterial properties and maximum inhibition zone based on the concerntration (quantity of the extract) of the secondary metabolites viz., flavonoids, alkaloids, steroids and tannins[12]. The growth and biomass production of *S. grandiflora* and *S. sesban* at 90 days were dependent on the distancing between two *Sesbania* species for two successive seasons which had an increase from 1 X 0.5 m up to 1 X 1.5m and the highest value were observed in *S. grandiflora* after establishment of one year[14]. An qualitative approach revealed that diarrhea, thrombosis, and inflammatory diseases, minute bacterial cruds were cured by utilization of antidote prepared from the leaf extract of *Sesbania grandiflora* L. Pers[15]. *Sesbania grandiflora* L. Pers was used in protection of liver and heart, also to cure kidney stones. In addition to this., it was used to treat microbial infections and anemia, also as human ailment to be treated as a laxative. The pharmacological activity of the plant was due to the presence of phytochemicals and phytonutrients which

were used potent therapeutic agents either alone or in combination alongwith other medicinal plants[16]. *Sesbania grandiflora* L. Pers being one among the widely used domesticated plant as in the treatment of various types of ailments. Fixing atmospheric nitrogen to improve soil conditions was done by the roots of *Sesbania grandiflora* L. Pers which was used as green manure. A wind-break or shade tree plantations created by the use of *Sesbania grandiflora* L. Pers possessed soft wood and light, used as floating fishing net poles, as firewood fuel and also in preparation of charcoal including it as a major source of pulp in the paper industry. The impact of environmental factors on the adaptation of the plant in new environments, its diversity affected the major therapeutic content in pharmaceuticals[17].

5. CONCLUSION

Various topographical features have contributed towards the fulfledged growth of the plants of *Sesbania grandiflora* L. Pers**.** The conditional factors like rainfall, pH, conductivity, water holding capacity also influenced the yield of the leaves in which, the low growth rate prevailed in high acidic nature of the soil and less acidic nature initiated more yield. From all the above observations., it was truely evident that some of the components tend to disappear or appear due to increase or decrease in temperature and atmospheric pressure. The phytochemical bonding changed or broke-up due to change in its valence electrons on its outer orbitals when observed in the ionic level. This directly confirmed that due to the breakage of the structures, the type of chemical bonding changed which lead to partial appearence or disappearence of the phytochemical components present in the plants.

6. AKNOWLEDGEMENTS

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7. AUTHORS CONTRIBUTION STATEMENT

Naveen Kumar. S. P., being the research scholar and first author of the above represented research work has carried out field studies, analysis of the soil, morphological studies, data interpretation and quoting suitable references. Maya C., Professor of Botany, has contributed in the compilation, correction, drafting, AP formatting and composition of the write –up work of the research.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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