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INFLUENCE OF HERBICIDES ON MORPHO-PHYSIOLOGICAL GROWTH PARAMETERS IN TURMERIC (*CURCUMA LONGA* L.)

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ABSTRACT
To study the influence of different herbicides on growth and growth parameters in turmeric with and without weeds and their influence on rhizome yield field studies were under taken at Main Agricultural Research Station, University of Agricultural Sciences Dharwad during *kharif* 2009-10. Result indicated that the efficacy of different herbicides was significant. Weed free check recorded higher values of all the morpho-physiological growth parameters in turmeric. Among the herbicides pre-emergence application of pendimethalin @1.5 kg a.i. ha^{-1} and 1.0 kg a.i. ha^{-1} recorded higher values of growth parameters. Weed free check and pendimethalin @ 1.5 kg ha^{-1} had higher weed control efficiency and higher growth values of LAI, LAD, AGR, CGR and NAR as compared to unweeded control. Higher growth values in weed free check and pendimethalin @ 1.5kg ha^{-1} increased the rhizome yield as against unweeded control.

INTRODUCTION

Turmeric (*Curcuma longa* L.), an herbaceous perennial plant, belonging to the family Zinziberaceae under the order Scitaminae is one of the most valuable spices all over the world. Turmeric is being grown during rainy season and is a long duration crop. Hence, a large number of weeds compete for nutrients, moisture and space causing considerable yield reduction (Daulay and Singh, 1982). Weeds pose most serious problem in turmeric because of the liberal use of farmyard manure, chemical fertilizers and frequent irrigations that help the weeds to grow vigorously. The predominant weed flora that rock the growth and yield of the crop vary with soil type, moisture condition and other climatic factors

It has been well established that the yield loss from weeds is quite higher (45%) than the pest (30%) and diseases (20%) (Rao, 1983). In the field of weed management during the last four decades, considerable developments have been taken place in chemical weed control, thereby increasing the crop returns by reducing the cost of production.

Jaiswal (1994) noticed that, weed control efficiency of different herbicides treatment

Ranged from 40 to 91 per cent and highest WCE was recorded in metribuzin (91%) treatment.

Leaf area duration is one of the growth components which has been shown to have direct effect on yield and dry matter production and observed that LAD is correlated with dry matter production and consequently, any practice that increase the longevity of green leaves should increase the dry weight of plants (Power *et al*., 1967). Leaf area ratio (LAR) is a morphological index of plant (leaf area per unit dry weight of the plant) which is closely connected with the photosynthetic activity of the leaves (Evans, 1972). However, the information on the role of herbicides on weed control efficiency in turmeric and morpho-physiological and biophysical parameters is meager. With this background, the present investigation was carried out to know influence of different herbicides on morpho-physiological traits in Turmeric.

MATERIALS AND METHODS

Field experiments were conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad 2009-10 during *kharif* season in turmeric cv. Salum. The soil of the experimental site was vertisol and clayey in nature. The experiments were laid out in randomized block design with twelve treatments viz. alachlor @ 1.0 and 1.5kg a.i./ha, Butachlor @ 1.0 and 1.5 kg a.i. ha^{-1} pendimethalin @ 1.0 and 1.5kg ai ha^{-1}, pretalachlor @ 1.0 and 1.5kg a.i. ha-1 and oxyfluorfen @0.2 and 0.3kg a.i. ha^{-1}, weed free check and unweeded control. The treatments were replicated thrice. All the herbicides were applied immediately after planting of turmeric in weed free check weeding was done as and when the weeds emerged. Nitrogen, phosphorus and potassium were applied @ 180:90:90 kg N, P_2O_5 and K_2O per ha. The other recommended package of practices was followed. The crop was harvested at full maturity. Dry weight of weeds was recorded at 60,120,180,240 DAP and weed control efficiency was calculated by using the formula given by Patel *et al*. (1983) Dry matter production in different plant parts was recorded at various growth stages.

The growth indices like Leaf Area Index (LAI) were calculated by using the formula suggested by Sestak *et al.*, 1971., Leaf area duration (LAD) and Leaf area ratio (LAR, dm^2 /g) by Power *et al.* (1967)., Net assimilation rate (NAR, mg dm^2/day) were calculated by using the formulae given by Gregory (1926), Absolute growth rate (AGR, g /plant/day) was calculated by using the following formula given by Radford (1967), Relative growth rate (RGR, mg/ g/plant) was calculated by using the formula of Blackman (1919) and Crop growth rate (CGR, g/m^2) was estimated, using formula given by Watson (1956).

RESULTS AND DISCUSSION

Weed dry matter is a better parameter to measure the competition than the weed number (Murthy, 1982; Bhanumurthy and Subramanian, 1989). Unwedded control recorded significantly higher weed biomass at all the stages of crop growth due to unchecked growth of weeds (Table 1). The lower dry weight of weeds in weed free check was due to complete removal of weeds whenever they emerged. The lower weed dry weight in weed control treatments may be ascribed to lesser number of weeds, rapid depletion of carbohydrate reserves of weeds through rapid respiration (Dakshinadas, 1962 and Hill and Santlemann, 1969).

Among various herbicides tried, pendimethalin @ 1.0kg a.i. per ha recorded the lowest weed dry matter followed by pendimethalin @ 1.5kg a.i. per ha at all the stages of crop growth, while oxyfluorfen @ 0.30kg a.i. per ha was least effective, which is attributed to the differential efficacy of herbicides in suppressing the weed growth (Table1). Similar results were also obtained by Gautam (1985) in cabbage and Patel *et al.* (1995) in potato.

Significantly higher weed control efficiency (%) was noticed in weed free check treatment because of the season long weed free conditions in that treatment (Table1). Among various herbicides, the higher weed control efficiency was obtained with pendimethalin @ 1.0 kg a.i. per ha and pendimethalin @ 1.5 kg a.i. per ha, while it was low with oxyfluorfen @ 0.20kg a.i. per ha due to its phytotoxic effect and resulted in lesser weed control efficiency. Similar results were also reported by Nadagouda (1995) and Nekar (1997).

The total dry matter produced is an indication of the overall utilization of resources and better light interception. The total dry matter accumulation found to be higher between 60 and 180 DAP as compared to other stages (Table 2). The weed free check recorded significantly higher total dry matter during 60, 120, 180, 240 DAP and at harvest and total dry matter was found to be lowest in unweeded control. This indicates that the weed competition affects various morphological traits and finally reduce the total dry matter production. Among various herbicides studied, pendimethalin was found to be very effective in suppressing the weed flora and eventually resulted in higher total dry matter production of turmeric. Similarly Channappagowda *et al.* (2007) found the effective control of weeds in potato. Leaf area and leaf area index (LAI) increased from 60 – 120 DAP and decreased from 180 DAP to harvest. The highest LAI was recorded in weed free check, while the lowest was observed in unweeded control (Table 2). Among the herbicides, the application of pendimethalin@ 1.5 and 1.0 kg a.i. per ha resulted in higher values for leaf area and leaf area index (LAI) at all the stages. However, application of oxyfluorfen @ 0.20 kg a.i. per ha was less effective in controlling the weeds and resulted in lower values for leaf area and leaf area index. The present investigation clearly indicated that pendimethalin @ 1.5 and 1.0 kg a.i. per ha controlled the weeds at all the stages and thus helps the turmeric crop to grow better with higher leaf expansion, finally resulting in higher values of leaf area index. The reduction in the LAI in rice due to weed competition was also observed by the Noda *et al.* (1969).

The data on net assimilation rate indicated significant differences due to various herbicide treatments (Table 3). In general, the NAR values were higher at 180 upto 240 DAP and decreased towards maturity.At 60 - 120 DAP, NAR values were significantly higher in weed free check (0.026) followed by pendimethalin @ 1.5kg a.i. per ha, pendimethalin @ 1.0kg a.i. per ha, alachlor @ 1.5kg a.i. per ha. The lower NAR values were found in unweeded control (0.012), followed by oxyfluorfen @ 0.20kg a.i. per ha, 0.30kg a.i. per ha. At 120 - 180 DAP, the treatment unweeded control (0.014), oxyfluorfen @ 0.20 kg a.i. per ha and oxyfluorfen @ 0.30kg a.i. per ha, registered significantly lower values of NAR compared to the

Table 1: Effect of herbicides and crop weed competition on total dry weight of weeds (g/m^2) and weed control efficiency (%) at different stages in turmeric

Sl. No.	Treatments	Total dry weight of weeds (g/m2)				Weed Control Efficiency (%)		
		60 DAP	120 DAP	180 DAP	240 DAP	60 DAP	120 DAP	180 DAP
1	Alachlor @ 1.0 kg a.i./ha	12.01	18.14	23.04	29.66	70	65	64
2	Alachlor @ 1.5 kg a.i./ha	10.00	16.00	21.30	27.70	75	69	67
3	Pendimethalin @ 1.0 kg a.i./ha	7.00	14.00	20.17	25.61	80	73	68
4	Pendimethalin @ 1.5 kg a.i./ha	8.00	13.00	18.06	23.26	82	75	72
5	Butachlor @ 1.0 kg a.i./ha	15.80	22.50	28.30	33.40	63	56	56
6	Butachlor @ 1.5 kg a.i./ha	14.33	21.00	27.26	32.10	64	59	58
7	Pretilachlor @ 1.0 kg a.i./ha	16.38	23.35	30.21	38.92	60	55	53
8	Pretilachlor @ 1.5 kg a.i./ha	15.00	22.81	28.84	36.23	62	56	55
9	Oxyfluorfen @ 0.20 kg a.i./ha	20.00	29.40	36.50	44.71	50	43	43
10	Oxyfluorfen @ 0.30 kg a.i./ha	18.01	27.50	34.89	42.12	55	47	46
11	Unweeded control	40.00	52.00	65.00	70.20	0.00	0.00	0.00
12	Weed free check	0.00	0.00	0.00	0.00	100	100	100
	S.Em ±	0.13	0.31	0.03	0.04	1.60	0.44	0.52
	CD at 5%	0.40	0.90	0.10	0.12	4.68	1.30	1.52

DAP - Days after planting

Table 2: Effect of herbicides on total dry matter (g/plant) and Leaf area index at different stages in turmeric

Sl. No.	Treatments	TDM (g/plant)				LAI			
		60 DAP	120 DAP	180 DAP	240 DAP	60 DAP	120 DAP	180 DAP	240 DAP
1	Alachlor @ 1.0 kg a.i./ha	17.49	37.40	70.40	89.20	0.92	1.20	1.19	1.17
2	Alachlor @ 1.5 kg a.i./ha	18.10	38.30	72.40	90.90	0.96	1.22	1.21	1.20
3	Pendimethalin @ 1.0 kg a.i./ha	18.40	40.40	73.70	92.23	1.02	1.22	1.22	1.21
4	Pendimethalin @ 1.5 kg a.i./ha	19.10	41.40	74.30	93.30	1.11	1.24	1.27	1.22
5	Butachlor @ 1.0 kg a.i./ha	16.00	36.76	69.00	88.10	0.89	1.20	1.16	1.15
6	Butachlor @ 1.5 kg a.i./ha	16.50	37.50	71.10	90.10	0.91	1.21	1.20	1.20
7	Pretilachlor @ 1.0 kg a.i./ha	15.40	35.30	68.80	84.30	0.88	1.20	1.14	1.14
8	Pretilachlor @ 1.5 kg a.i./ha	16.00	36.96	69.90	87.10	0.90	1.21	1.18	1.14
9	Oxyfluorfen @ 0.20 kg a.i./ha	14.15	33.50	66.80	83.20	0.75	1.17	1.14	1.06
10	Oxyfluorfen @ 0.30 kg a.i./ha	15.10	33.80	68.00	85.90	0.85	1.17	1.15	1.07
11	Unweeded control	13.57	30.70	57.00	74.70	0.55	0.89	1.02	0.88
12	Weed free check	21.23	49.93	81.15	99.24	1.24	1.40	1.38	1.36
	S.Em ±	0.21	0.31	0.017	0.36	0.006	0.01	0.02	0.013
	CD at 5%	0.61	0.90	0.05	1.05	0.020	0.03	0.06	0.040

DAP - Days after planting

Table 3: Effect of herbicides on net assimilation rate (g/dm²/day), leaf area ratio (cm²/plant) and leaf area duration (LAD, days) at different stages in turmeric

Sl. No.	Treatments	NAR (g/dm2/day)			LAR(cm2/plant)				LAD (days)		
		60-120 DAP	120-180 DAP	180-240 DAP	60 DAP	120 DAP	180 DAP	240 DAP	60-120 DAP	120-180 DAP	180-240 DAP
1	Alachlor @ 1.0 kg a.i./ha	0.020	0.022	0.031	95.2	58.7	30.6	23.6	63.6	72.0	70.8
2	Alachlor @ 1.5 kg a.i./ha	0.023	0.023	0.032	96.4	57.5	30.2	23.7	65.4	73.2	72.3
3	Pendimethalin @ 1.0 kg a.i./ha	0.023	0.024	0.034	100.1	54.5	29.8	23.7	67.2	73.2	72.9
4	Pendimethalin @ 1.5 kg a.i./ha	0.024	0.025	0.035	104.7	54.0	30.9	23.5	70.5	75.0	73.8
5	Butachlor @ 1.0 kg a.i./ha	0.020	0.021	0.028	100.9	59.2	30.4	25.06	62.7	70.8	69.3
6	Butachlor @ 1.5 kg a.i./ha	0.020	0.022	0.029	100.3	58.4	30.4	24.0	63.6	72.0	72.0
7	Pretilachlor @ 1.0 kg a.i./ha	0.018	0.021	0.025	103.5	58.3	31.5	24.4	62.4	70.2	68.4
8	Pretilachlor @ 1.5 kg a.i./ha	0.020	0.021	0.025	101.3	57.6	31.1	23.7	63.3	71.4	69.6
9	Oxyfluorfen @ 0.20 kg a.i./ha	0.019	0.021	0.023	95.6	61.3	31.6	22.9	57.6	69.0	66.0
10	Oxyfluorfen @ 0.30 kg a.i./ha	0.020	0.021	0.023	102.5	61.7	31.1	22.5	60.6	69.6	66.6
11	Unweeded control	0.012	0.014	0.016	105.4	52.6	32.26	21.3	43.2	60.0	57.0
12	Weed free check	0.026	0.027	0036	73.9	50.0	31.0	24.7	79.2	83.4	82.2
	S.Em ±	0.012	0.0007	0.0017	0.17	0.01	0.20	0.006	0.47	0.16	0.32
	CD at 5%	0.0035	0.0020	0.0049	0.50	0.04	0.60	0.02	1.38	0.49	0.95

DAP - Days after planting

rest of treatments. The similar trend was observed at 180 - 240 and 240-harvest, similar results was also observed by Channappagowdar *et al.* (2007).

Leaf area ratio (LAR) indicates the size of assimilatory surface area in relation to total dry matter accumulation. The LAR was more during early stages of crop growth and decreased towards maturity (Table 3). Among the treatments, higher LAR was recorded in unweeded control and the lowest was noticed in weed free check. The increased LAR due to weed competition indicate that there is a tendency to produce more leaf area per unit dry matter for better light interception under competition with weeds. Among the herbicides, pendimethalin @ 1.0kg a.i. per ha recorded the lower LAR, Dobozi and Lehoczky (2002) also noticed the similar results

The leaf area duration (LAD) is the total amount of leaf area present over a particular period of growth. LAD is an important growth parameter that influences competition. LAD values were highest in weed free check followed by the application of pendimethalin @ 1.5kg a.i. per ha (Table 3). Application of oxyfluorfen @ 1.0 kg a.i. per ha and unweeded control recorded lower values for LAD. The improvement in LAD values particularly at later stages of the crop growth is beneficial. The use of pendimethalin @ 1.5kg a.i. per ha was found to be more effective by decreasing crop weed competition and thereby increasing the LAD, particularly at later phases of crop development, which subsequently resulted in higher yield. Pandey and Shukla (1990) noticed decreased LAD due to weed competition. Thus, any attempt to increase the LAD values through the use of appropriate herbicides is a feasible approach.

Significant differences in plant height were noticed due to weed control treatments at all the stages (Table 4). The highest plant height was found in weed free check at all the stages. Pendimethalin @ 1.5kg a.i. per ha, pendimethalin @ 1.0kg a.i. per ha and alachlor @ 1.5kg a.i. per ha provided weed free condition for longer period of crop growth and resulted in enhanced plant height. The crop growth was adversely affected by weeds in unweeded control due to heavy competition with crop for nutrients, moisture, space and light leading to suppressed crop growth.

At 60 DAP, number of leaves were significantly higher in weed free check (9.23) followed by pendimethalin (8.07) @ 1.5kg a.i. per ha, pendimethalin @ 1.0kg a.i. per ha (8.05) and alachlor @ 1.0kg a.i. per ha (7.60) (Table 4). While, unweeded control recorded lower values for number of leaves (6.15), followed by the oxyfluorfen @ 0.30 and 0.20kg a.i. per ha

Table 4: Effect of herbicides on plant height (cm), number of leaves/plant, crop growth rate (g/m²/day), relative growth rate (g/g/day) and absolute growth rate (g/plant/day) at different stages in turmeric

Sl. No.	Treatments	Plant height (cm)				Number of leaves/plant				CGR (g/m2/day)			RGR (g/g/day)			AGR (g/plant/day)		
		60 DAP	120 DAP	180 DAP	240 DAP	60 DAP	120 DAP	180 DAP	240 DAP	60-120 DAP	120-180 DAP	180-240 DAP	60-120 DAP	120-180 DAP	180-240 DAP	60-120 DAP	120-180 DAP	180-240 DAP
1	Alachlor @ 1.0 kg a.i./ha	21.3	23.8	31.4	39.7	7.60	12.77	18.46	13.00	1.84	3.05	1.74	0.026	0.022	0.020	0.33	0.55	0.31
2	Alachlor @ 1.5 kg a.i./ha	22.7	24.1	32.9	41.0	7.63	13.00	18.80	13.70	1.86	3.15	1.71	0.027	0.023	0.020	0.33	0.56	0.31
3	Pendimethalin @ 1.0 kg a.i./ha	23.2	24.4	33.1	40.2	8.05	13.20	19.00	14.25	2.03	3.04	1.71	0.033	0.023	0.022	0.36	0.56	0.30
4	Pendimethalin @ 1.5 kg a.i./ha	25.3	26. 7	33.6	41.2	8.07	13.30	19.09	14.45	2.06	3.08	1.75	0.035	0.025	0.023	0.37	0.54	0.31
5	Butachlor @ 1.0 kg a.i./ha	21.1	23.3	31.5	41.2	7.37	11.50	18.18	13.52	1.92	2.98	1.76	0.024	0.021	0.019	0.35	0.53	0.31
6	Butachlor @ 1.5 kg a.i./ha	22.0	23.8	32.3	41.8	7.53	12.10	18.28	13.77	1.94	3.10	1.71	0.024	0.022	0.019	0.35	0.56	0.31
7	Pretilachlor @ 1.0 kg a.i./ha	20.6	22.2	29.9	36.7	7.47	11.37	16.47	12.07	1.84	3.09	1.43	0.020	0.020	0.017	0.33	0.55	0.25
8	Pretilachlor @ 1.5 kg a.i./ha	21.9	23.0	31.3	37.8	7.53	11.67	16.63	12.43	1.93	3.05	1.59	0.021	0.021	0.018	0.35	0.54	0.28
9	Oxyfluorfen @ 0.20 kg a.i./ha	18.9	20.9	29.1	35.5	6.43	10.57	11.52	10.37	1.79	3.08	1.51	0.018	0.017	0.016	0.32	0.56	0.27
10	Oxyfluorfen @ 0.30 kg a.i./ha	19.8	21.5	29.1	35.6	6.53	10.50	11.65	10.72	1.73	3.16	1.65	0.019	0.018	0.017	0.31	0.57	0.29
11	Unweeded control	14.3	19.3	19.9	29.5	6.15	11.40	14.57	8.63	1.58	2.43	1.63	0.016	0.014	0.011	0.28	0.43	0.28
12	Weed free check	28.1	29.2	37.4	43.3	9.23	15.23	22.80	17.70	2.65	4.88	2.67	0.036	0.026	0.024	0.47	0.52	0.30
	S.Em ±	0.17	0.21	0.26	0.36	0.11	0.25	0.26	0.17	0.02	0.01	0.03	0.002	0.001	0.001	0.01	0.0006	0.0007
	CD at 5%	0.51	0.61	0.76	1.03	0.32	0.75	0.78	0.51	0.07	0.04	0.10	0.005	0.003	0.003	003	NS	NS

DAP - Days after planting

(6.53 and 6.43, respectively) and pretilachlor @ 1.5kg a.i. per ha (7.53) as compared to other treatment at all the stages. The same trend was noticed at 120, 180, 240 DAP and at harvest.

The absolute growth rate (AGR) refers to dry weight increase per unit time. AGR increased from 60-120 DAP; 120-180 DAP and decreased thereafter (Table 4). Weed free check recorded higher AGR values, while lower was with unweeded control. This clearly indicates the efficiency of the plant in terms of dry matter production is hindered due to weed competition. Among the herbicides, application of pendimethalin @ 1.5kg a.i. per ha was found to be more effective and resulted in significantly higher values for AGR.

Crop growth rate (CGR) is influenced by LAI, photosynthetic rate and leaf angle (Table 4). The specific leaf weight (SLW) is an index of leaf thickness and it increased from 60 to 120 DAP and decreased slightly from 120 DAP to harvest. The higher values for CGR, NAR and SLW were found in weed free check. However, the lowest values for the above said traits were noticed in unweeded control.

The RGR values during 60 to 120 DAP indicated that, it was significantly higher in weed free check (0.036) followed by pendimethalin @ 1.5 kg a.i. per ha (table 4) and pendimethalin @ 1.0 kg a.i. per ha, while the RGR values were found to be lower in unweeded control (0.016) followed by oxyfluorfen @ 0.20 kg a.i. per ha, oxyfluorfen @ 0.30 kg a.i. per ha (0.018, 0.019, respectively). At 120 to 180 DAP, the treatments unweeded control (0.014), oxyfluorfen @ 0.20 and 0.30 kg a.i. per ha and pretilachlor @ 1.0 kg a.i. per ha registered significantly lower values as compared to other treatments. The RGR values were found to be significantly higher in weed free check (0.026), followed by pendimethalin @ 1.5 kg a.i. per ha, pendimethalin @ 1.0kg a.i. per ha and alachlor @ 1.5kg a.i. per ha, which were on par with each other. Similar trend was also observed at 180 to 240 DAP and 240 DAP to harvest.

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NATIONAL ENVIRONMENTALISTS ASSOCIATION

AND ITS OFFICIAL ORGAN

The Bioscan

An International Quarterly Journal of Life Science

Started in 1988, the National Environmentalists Association has been reorganized in 2006 and now is an association functioning with full vigour and new impetus to meet its objectives with the co-operation of like minded environment conscious academicians from different parts of the nation.

MEMBERSHIP OF THE ASSOCIATION

Any graduate having interest in environmental conservation and protection of nature and natural resources can be the member of the association.

To be the member of the association the application form given below should be duly filled up and sent to the Secretary of the association along with a demand draft of Rs. 750/- (After the 25% concession) for annual membership and Rs. 7500/- (After the 25% concession) for life membership.

FELLOWSHIP OF THE ASSOCIATION

The Association is awarding FELLOWSHIP to deserving academicians / researchers /scientists who are LIFE MEMBERS of the Association after reviewing their bio-data by the Fellows and the Executive Members of the association. The Fellows are privileged to write **F.N.E.A.** after their names **.**The prestigious Fellowship also includes a citation in recognition of their contribution to society in general and the endeavour for the noble cause of environment in particular.

AWARDS OF THE ASSOCIATION

The Association in its Seminars and Conferences provides the following category of awards on annual basis.

1. **The young scientists award** : It is given to the researchers below the age of 35 years.

2. **The senior scientists award** : It is awarded to the academicians above the age of 35 years.

3. **The best paper award**: It is awarded to the contributor of the Journal **The Bioscan** during the year.

4. **The best paper presentation award** : It is awarded to the scholar whose presentation is the best other than the young scientist category.

5. **The best oration award** : It is awarded to the scholar who delivered invited speech.

6. **The recognition award** : It is awarded to those senior scholars who have contributed to the subject through their continued research .

7. **The environmental awareness award** : It is awarded to those who, apart from their research contribution, have done commendable extension work for environmental betterment.

The number of recipients of award in each category will vary depending upon the recommendation of the panel of judges and the executive committee. The association has the provision to institute awards in the name of persons for whom a with desired sum is donated in consultation with the executive body.

PUBLICATION OF THE ASSOCIATION

In order to provide a platform to a vast group of researchers to express their views and finding of research as well as to promote the attitude of quality research among the scholars of younger generation the association publishes an international quarterly journal – **THE BIOSCAN (ISSN:0973-7049).** For the benefit of the potential contributors **instructions to authors** is given separately in this journal. However, the details regarding the journal and also the association can be seen on our website *www.thebioscan.in.*

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