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Growth and Collaboration Trends in Livestock Research in India: A Scientometrics Analysis

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Abstract - **This paper attempts to analyse the growth and development of Livestock research in India, as reflected in publication output covered by Science Citation Index (SCI) during 1999-2010. The Indian scientists published a total of 600 papers in SCI covered journals during the above period. The present study analyses the broad features of Indian output in the field of livestock by focusing on its publication growth characteristics, language, format and media of communication, research quality, institutional productivity, patterns of research collaboration, and broad and narrow subject areas of interests of Indian institutions and scientists. A broad comparison of India's research output with select countries has also been made.**

Keywords: **Bibliometrics, Livestock, Scientometrics**

I. Introduction

The terms bibliometrics and scientometrics have been introduced simultaneously by Pritchard, Nalimov and Mulchenko in 1969. Pritchard [1] defined the term 'Bibliometrics' as the application of mathematical and statistical methods to books and other communication medium.

Scientometrics is the measurement of science communication, and bibliometrics deals with more general information processes. Major boost to the scientometrics research was with the publication of the journal 'Scientometrics' in late seventies particularly devoted to bibliometrics/scientometrics. With the advent of Information and Communication Technology (ICT), web technology and availability of different databases online, the field of bibliometrics gain a momentum. Increasing CPU speed and online availability of various databases makes bibliometrics research much easier and no longer a manual task. This study aims to find out the growth pattern, core journals, authorship pattern and productive authors in this field.

Livestock is emerging as a driving force in the growth of agricultural sector of India. Several factors underline this development. The importance of livestock in India goes beyond the function of food production. It is an important source of draught power, manure for crop production and fuel for domestic use. Thus, by minimizing use of nonrenewable energy, livestock make a positive contribution to the environment. Although crops and livestock are interdependent to a large extent, the latter constitute an important mechanism for coping with the risks of crop failure. In land-scarce economies livestock provide livelihood support in terms of income and employment generation to the millions of landless and small landholders. In India, livestock wealth is mainly concentrated among the majority of marginal and small landholders.

Contribution of livestock to agricultural gross domestic product (AgGDP) has been rising; it increased from 14 % in 1980-81 to 23 % in 1997-98. Demand for livestock products is income-elastic, and sustained growth in per capita income, rising urban population, and changing food habits and lifestyles are fuelling further growth in it. Livestock research receives about 19 % of the agricultural research resources. This however has witnessed considerable variation over time [2].

II. Objectives

The main focus of the study are :

1. To analyse the status, publication share, rank and growth of India's research output among the top 10 productive countries in livestock;
2. To analyse productivity and quality of Indian research output in livestock;
3. To analyse the productivity and quality of 10 major institutions participating in research in livestock;
4. To analyse the productivity and quality of leading 10 authors in research in livestock.

III. Materials And Methods

Publications data was collected from the SCI (1999-2010) published by the Institute of Scientific Information, Philadelphia (now a division of the Thomson Corporation). A total of 600 publications records from Indian scientists and institutions were downloaded and analysed as per objectives of the study.

TABLE I GLOBAL SHARE OF PUBLICATION IN THE FIELD OF LIVESTOCK

S.No.	Countries	Publications	%	Cumulative	Cum. %
1	USA	4243	29.44	4243	29.44
2	England	1352	9.38	5595	38.82
3	Australia	995	6.90	6590	45.72
4	Germany	856	5.94	7446	51.66
5	Canada	776	5.38	8222	57.04
6	France	708	4.91	8930	61.95
7	India	600	4.16	9530	66.12
8	Scotland	553	3.84	10083	69.95
9	Spain	546	3.79	10629	73.74
10	Netherland	524	3.64	11153	77.38
11	Others	3261	22.62	14414	100
	Total	14414	100		

IV. RESULTS AND DISCUSSION

Publication share of top 10 countries in the field of Livestock are shown in Table I. Global share of publications in the field of Livestock reveals that 29.44% of the total articles were contributed by the authors from USA, followed by England (9.38%), Australia (6.90%) and Germany (5.94%) respectively. Only 4.16% of articles are contributed by authors in India and ranked 7th among top 10 countries.

During 1999-2010, about 600 papers were published on livestock by Indian authors. The average number of papers produced per year was 54.55. The highest numbers of papers (95) were published in the years 2010. Figure 1 shows that growth of the literature was low during 1999-2010.

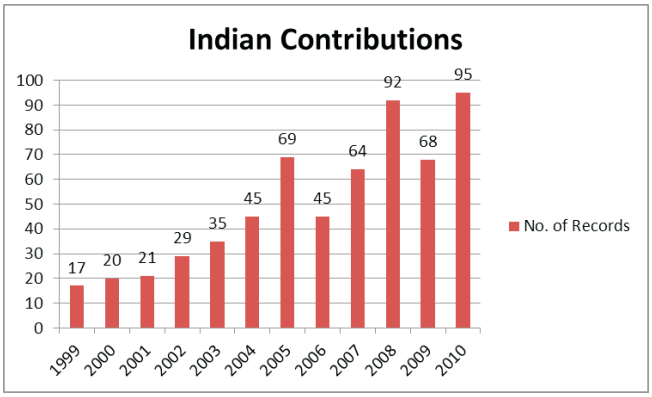

Fig. 1 Growth of the Literature

Table II shows that maximum number of publications are 519 (86.50%). This is followed by Review (9.67%) and Proceedings Paper (2.83%).

TABLE II BIBLIOGRAPHIC FORM

Document Types	No. of Records	%
Article	519	86.50
Review	58	9.67
Proceedings Paper	17	2.83
Editorial Materials	2	0.33
Letter	2	0.33
Meeting Abstract	2	0.33
Total	600	100

Most prolific authors along with their affiliation in the field of Livestock are listed in Table III. Citations received by the authors and the h index are also provided in Table III as reflected in Web of Science database.

In all, there were 1833 authors who contributed to this field. The most prolific Indian authors were Kumar.A. with 16 papers followed by Mishra.C. with 14 papers; Chander,M., Maikhuri.R.K., and Singh.V. with 9 papers.

The degree of collaboration is calculated using the formula given by K.Subramanyan [3], As per the formula:

Degree of collaboration, $DC = N_m/N_m+N_s$ Where DC = Degree of collaboration N_m = Number of multiauthored research papers in a discipline published during a period.

N_s = Number of single authored research papers in a discipline published during the same period.

Authorship pattern of Indian contributors in the field of Livestock has been listed in Table IV.

TABLE III TOP 10 INDIAN AUTHORS AND THEIR CITATIONS

S. No.	Authors	Affiliation	No. of Records	Citations	h index
1	Kumar A	Indian Grassland & Fodder Res Institute, Plant Animal Relationship Division, Jhansi 284003, Uttar Pradesh, India	16	25	3
2	Mishra C	Snow Leopard Trust & Nat Conservation Foundation, Mysore 570002, Karnataka, India	14	230	8
3	Chander M	Indian Vet Res Institute, Division Extension Education, Izatnagar 243122, Uttar Pradesh, India	9	8	2
4	Maikhuri RK	GB Pant Institute Himalayan Environment & Development, Garhwal Unit, Srinagar 246174, Uttarakhand, India	9	131	6
5	Singh V	Registered Research Center Indian Grassland, Department Environmental Science, Palampur 176062, Himachal Pradesh, India	9	12	2
6	Bagchi S	Nat Conservation Foundation, Mysore 570002, Karnataka, India	8	104	5
7	Bhatnagar YV	Snow Leopard Trust & Nat Conservation Foundation, Mysore 570002, Karnataka, India	8	75	5
8	Cuthbert R	Bombay National Historical Society, Bombay 400023, Maharashtra, India	8	113	7
9	Das SK	Indian Vet Res Institute, Izatnagar 243122, Uttar Pradesh, India	8	3	1
10	Kumar S	Central Institute of Research Goats, Microbiological Lab, Mathura 281122, UP, India	8	33	3

TABLE IV AUTHORSHIP PATTERN

Sl. No.	Number of Authors	No. of Records	%
1	Single Author	50	8.33
2	Two Authors	127	21.17
3	Three Authors	154	25.67
4	Four Authors	122	20.33
5	Five Authors	53	8.83
6	More Than Five Authors	44	7.33
	Degree of Collaboration	0.92	

Only 50 articles have been produced by the single author and 550 articles were produced by two or more than two authors, which shows the collaborative research. Degree of collaboration in the field of Livestock by the Indian authors shows 0.92 and shows that solo authors are less than 10%.

Indian scientists in the field of Livestock preferred to publish their articles in the journals listed in Table V.

It is observed from the Table VI, Indian Veterinary Research Institute produced 65 articles in the field of Livestock and it is followed by Wildlife Institute of India (23), National Conservation and National Diary Research Institute (each 22 respectively). Indian Grassland Fodlar Research Institute produced 16 articles but received only 3 citations hence its h index is only one. Wildlife Institute of Indian and National Conservation produced 22 articles each and their h index is also equal (9) even though National Conservation received 279 citations.

Subject areas covered in the Web of Science under the major subject Livestock are shown in Table VII.

It is observed from the Table VII, top 3 subjects produced more than 50% of the articles. The main subject areas of the livestock are Agriculture (34.83%), Vertinary Sciences (15.83%), Environmental Sciences Ecology (14.17%).

TABLE V JOURNALS PREFERRED BY THE INDIAN SCIENTISTS FOR PUBLICATION

S.No.	Indian Journal Title	No. of Records	%	Cumu lative	Cum. %
1	Indian Journal of Animal Sciences	119	22.93	119	22.93
2	Indian Veterinary Journal	60	11.56	179	34.49
3	Current Science	16	3.08	195	37.57
4	Asian Australasian Journal Of Animal Sciences	13	2.50	208	40.08
5	Indian Journal Of Traditional Knowledge	13	2.50	221	42.58
6	Range Management And Agroforestry	12	2.31	233	44.89
7	Animal Nutrition And Feed Technology	9	1.73	242	46.63
8	Indian Journal Of Animal Research	9	1.73	251	48.36
9	Field Crops Research	8	1.54	259	49.90
10	Oryx	8	1.54	267	51.45
11	Tropical Animal Health And Production	7	1.35	274	52.79
12	Biological Conservation	6	1.16	280	53.95
13	Environmental Conservation	6	1.16	286	55.11
14	International Journal Of Sustainable Development And World Ecology	6	1.16	292	56.26
15	Journal of Zoology	6	1.16	298	57.42
16	Outlook On Agriculture	6	1.16	304	58.57
17	Computers and Electronics In Agriculture	5	0.96	309	59.54
18	Journal of Applied Ecology	5	0.96	314	60.50
19	Mountain Research And Development	5	0.96	319	61.46
20	Revue Scientifique Et Technique Office International Des Epizooties	5	0.96	324	62.43
21	Agriculture Ecosystems Environment	4	0.77	328	63.20
22	Animal Conservation	4	0.77	332	63.97
23	Journal of Environmental Biology	4	0.77	336	64.74
24	Journal of Helminthology	4	0.77	340	65.51
25	Theriogenology	4	0.77	344	66.28
26	Animal Biotechnology	3	0.58	347	66.86
27	Annals of Arid Zone	3	0.58	350	67.44
28	Asian Journal Of Chemistry	3	0.58	353	68.02
29	Atmospheric Environment	3	0.58	356	68.59
30	Bioresource Technology	3	0.58	359	69.17
31	Bmc Genetics	3	0.58	362	69.75
32	Buffalo Bulletin	3	0.58	365	70.33
33	Conservation Biology	3	0.58	368	70.91
34	Environmental Management	3	0.58	371	71.48
35	Experimental Agriculture	3	0.58	374	72.06
36	Indian Journal Of Agricultural Sciences	3	0.58	377	72.64
37	Journal of Food Science And Technology Mysore	3	0.58	380	73.22
38	Journal of Mountain Science	3	0.58	383	73.80
39	Journal of Sustainable Agriculture	3	0.58	386	74.37

TABLE VII SUBJECT AREAS

S.No.	Subject Areas	No. of Records	%	Cumulative	Cum. %
1	Agriculture	215	35.83	215	35.83
2	Veterinary Sciences	95	15.83	310	51.66
3	Environmental Sciences Ecology	85	14.17	395	65.83
4	Science Technology Other Topics	22	3.67	417	69.50
5	Zoology	21	3.50	438	73.00
6	Biodiversity Conservation	16	2.67	454	75.66
7	Plant Sciences	16	2.67	470	78.33
8	Genetics Heredity	10	1.67	480	80.00
9	Biotechnology Applied Microbiology	9	1.50	489	81.50
10	Food Science Technology	8	1.33	497	82.83
11	Microbiology	7	1.17	504	84.00
12	Life Sciences Biomedicine Other Topics	7	1.17	511	85.16
13	Energy Fuels	6	1.00	517	86.16
14	Chemistry	4	0.67	521	86.83
15	Biochemistry Molecular Biology	4	0.67	525	87.50
16	Engineering	3	0.50	528	88.00
17	Water Resources	3	0.50	531	88.50
18	Parasitology	2	0.33	533	88.83
19	Business Economics	2	0.33	535	89.16
20	Immunology	2	0.33	537	89.50
21	Physical Geography	2	0.33	539	89.83
22	Reproductive Biology	2	0.33	541	90.16
23	Computer Science	2	0.33	543	90.50
24	Meteorology Atmospheric Sciences	2	0.33	545	90.83
25	Toxicology	2	0.33	547	91.16
26	Forestry	2	0.33	549	91.50
27	Public Administration	2	0.33	551	91.83
28	Anthropology	2	0.33	553	92.16
29	Nutrition Dietetics	2	0.33	555	92.50
30	Public Environmental Occupational Health	2	0.33	557	92.83
31	Sociology	2	0.33	559	93.16
32	Biophysics	2	0.33	561	93.50
	Others	39	6.50	600	100
	Total	600	100		

TABLE VI TOP 10 INDIAN INSTITUTIONS

S.No.	Institutions	No. of Records	Citations	h index
1	Indian Veterinary Research Institute	65	221	8
2	Wildlife Institute of India	23	240	9
3	National Conservation	22	279	9
4	National Diary Research Institute	22	45	4
5	Indian Grassland Fodlar Research Institute	16	3	1
6	Govind Ballabh Pant University Agricultural Technology	15	19	2
7	GB Pant Institute Himalayan Environmental Development	14	140	6
8	Central Institute of Research Goats	13	23	2
9	National Bureau of Animal Genetics Resources	13	23	3
10	National Institute of Animal Nurtrition Physiology	12	34	3

V. CONCLUSION

The study shows that livestock in India continues to be on growth track, in 1999–2010. Its world share in livestock is, however, still the lowest (4.16%) compared to rest of the top 10 world countries during the study period. The task is even more challenging in view of the fact that publications share of different Indian geographical regions is not changing with time. The study reveals that there has been a growing evident from the rise in the number of publications from 17 in 1999 to 95 in 2010. The publication output was maximum in Agriculture (34.83%), Vertinary Sciences (15.83%) and Environmental Sciences Ecology (14.17%). The average impact of all coauthored papers has been found to be 0.92. It may be considered a good performance as compared to the overall impact of Indian research papers.

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