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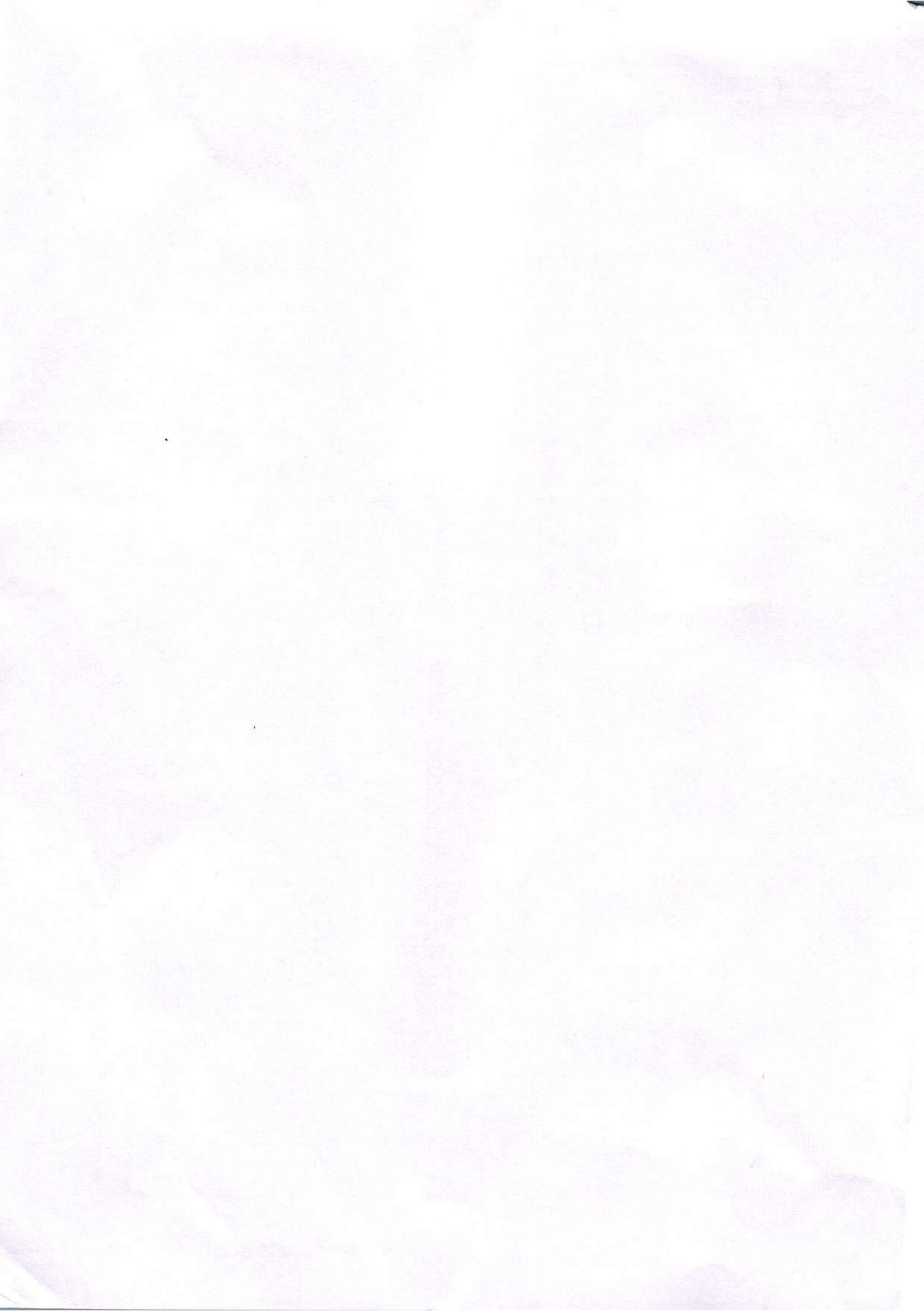
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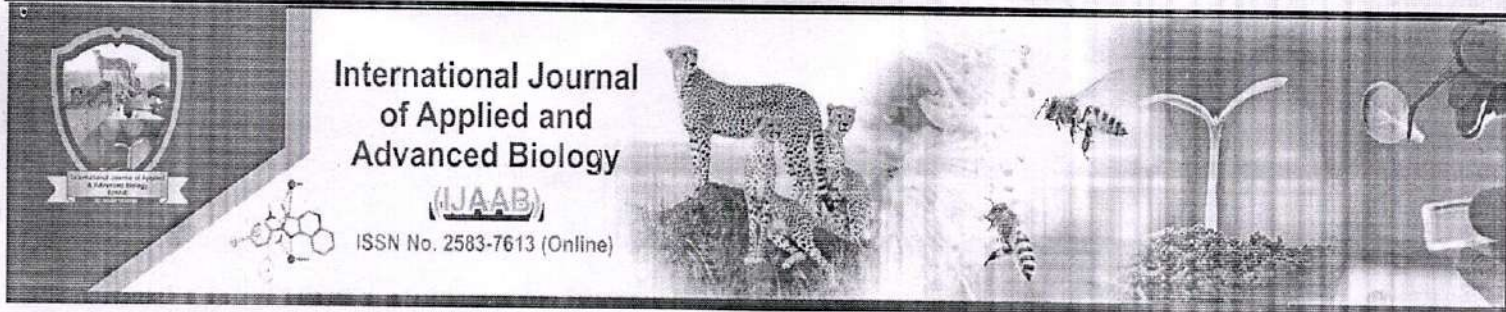
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## Study on Antimicrobial Activity of *Sapindus trifoliates* L.

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### ABSTRACT

*Sapindus trifoliates* L. is an extremely valuable medicinal plant distributed in tropical and subtropical regions of Asia. Plant extracts appear to be one of the better alternatives as they are known to have a minimal environmental impact and danger to consume in contrast to synthetic pesticides. The seed extracts of *Sapindus trifoliates* L. exhibited activity against *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The antimicrobial activity of each plant extract was tested against bacterial and fungal organisms i.e. *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *E. coli*. *Aspergillus niger*, *Aspergillus flavus* and *Fusarium* spp.

The antimicrobial activity was done for Chloroform, Ethyl Alcohol, Petroleum Ether, Acetone and Aqueous extracts. The ethanol extract showed antifungal activity against *Aspergillus fumigates* and *Aspergillus niger* at 100% plant extract. The inhibitory activity of the various seed

extracts like Chloroform, Acetone, Petroleum ether, Ethyl alcohol and aqueous were observed.

**Keywords:** Antimicrobial Activity, *Sapindus trifoliates* L., Soxlet Extraction.

### INTRODUCTION

Medicinal plants are important sources of potentially useful new compounds for the development of chemotherapeutic agents. The genus *Sapindus* belongs to the family Sapindaceae. The major compounds isolated from genus *sapindus* are saponins, triterpenoids, fatty acids, and flavonoids are well known for their antimicrobial, antidiabetic, cytotoxic, molluscicidal, fungicidal and inflammatory activities. (Sharma A. et.al 2011.).

The seeds of *Sapindus mukorossi* L. are used in Ayurvedic medicine to remove tan and freckles from the skin (Aparna Upadhyay & D.K. Singh 2012).

The first step towards this is the screening of plants used in medicine. Hence antibacterial research is going towards the discovery and development of antibacterial and antifungal agents. The screening of plants for their biologically active principles is done based on chemo-taxonomic investigations or ethno botanical knowledge of a particular disease (Sohni YRet.al., 1995).

Phytochemical work on different parts such as Fruit, Pericarp, Seeds, Leaves, Ripe Fruit, Roots, and Stems of *Sapindus mukorossi* L., *Sapindus saponaira* L. and *Sapindus trifoliatus* L. (Ibrahim 2015).

Due to increasing price of chemical drug, it is a need to find out cheaper drugs from natural resources. In recent years more species have been evaluated for their antimicrobial activity. The medicinal plant *Sapindus trifoliatus* L. is selected for the present study and is aimed at screening the antimicrobial properties against the selected pathogenic bacteria and fungal organisms. Dry seeds of *Sapindus trifoliatus* L. are one of the oldest cultivated medicinal plants in the world. In fact botanists traced it to the period of Vedas about 5000 years ago. (Aruna Pai 2014).

It is a medium size deciduous tree growing wild in South India. Fruits of *Sapindus trifoliatus* L. are rich in saponins. The seed is also used in Ayurvedic medicine to remove freckles and tan from the skin and for cleansing hair. The major compounds isolated from the plants are triterpenoids, fatty acids, steroids, alkaloids, carbohydrates, saponins, and flavonoids. They are also known for their antidiabetic, fungicidal, anti-inflammatory, antimicrobial and cytotoxic activities. (S.Priya1 and M. Mohanapriya 2021).

*Sapindus* is a genus of about five to twelve species of shrubs and small trees, native to warm temperate humid regions. The genus includes together deciduous and evergreen species. The members of the genus are commonly known as soap berries or soap nuts because the fruit pulp is used to make soap. The fruits are solitary globose and appear in the month of July-August. Experiments demon-starting the physiological, immunological and pharmacological properties of saponins have stimulated considerable clinical interest in these substances (Denise D. Pelegrini ET. Al 2008).

The *Sapindus trifoliatus* L. is a large, deciduous tree with a straight trunk up to 12 m in height, sometime attaining a height of 20 m and a girth of 1.8 m, with a globose crown and rather fine leathery foliage. Leaves are 30 to 50 cm long, alternate, paripinnate; common petiole very narrowly bordered, glabrous; leaflets 5-10 pairs, opposite or alternate, 5-18 by 2.5-5 cm, lanceolate, acuminate, entire, glabrous, often slightly falcate or oblique; petioles 2-5 m long. Seeds are 0.8 to 1.3 cm in diameter, globose, smooth, black and loosely placed in dry fruit (M. Rajeshwari et.al 2016).

The fruit is valued for the saponins (10.1%) present in the Pericarp which founds up to 56.5% of the drupe known for inhibiting tumor cell growth. (Varsha Parcha et. al. 2020). The fruit contains an active principle Saponin which ranges from 6-10 % of mass weight. The plant has been reported for its high content of Saponin and Sugar (Azhar I. et. al., 1994). Saponins are glycoside compounds and have many biological properties like hemolytic and antimicrobial effects. (Meltem

Mert Eren et.al. 2021). It is used to treat various diseases by Ayurveda is traditional physicians. Knowledge on medicinal uses of *Sapindus trifoliatus* L. is scattered. (E.R.H.S.S. Ediriweera et. al. 2021). The present study focused on Antimicrobial activity and Antifungal activity.

## MATERIALS AND METHODS

### Collection of Plant Material:

Seeds of *Sapindus trifoliatus* L. were collected from the local market. The Pericarp of Fruits was shade dried at room temperature for 25-30 days and crushed into the grinder.

### Preparation of plant extract:

25 gm powder of plant material was sequentially extracted with different solvents in the Soxlet apparatus. The solvent used for extraction included Chloroform, Acetone, Petroleum Ether, Water and Alcohol. The respective extract was dried in Petri plates using the electrical oven at 50°C for 2-4 days to field solid/semi-solid residue working extract was prepared by adding it to DMSO solution at a concentration of 25gm/ml.

### Soxlet Extraction of *Sapindus trifoliatus* L.:

For the extraction of *Sapindus trifoliatus* L., the crushed seeds Pericarp are used. In a Soxlet apparatus, the extraction thimble is fitted in between a round bottom flask at the bottom and a bulb condenser at the top. Inside the thimble holder solid matrix seed is wrapped within the packing. The packed bed is in contact with pure solvent for the extract to be transferred from the solid matrix to a fluid medium and the extract is leached out. The mass transfer occurs during solvent extraction in a packed column.

### Antimicrobial assays:

The antimicrobial assays were carried out by Antibacterial activity of plant extracts were carried out against bacterial pathogens, such as *E.coli* and *staphylococcus aureus* using agar well diffusion method.

### Disc diffusion method:

A sterile filter disc (diameter -4 mm, Whatmann paper No.-3) was placed in Petri dishes filled with Mueller Hinton agar and seeded with 0.3 ml of the test organism. The disc was impregnated with the test concentration of the compounds investigated dissolved in DMSO. The zones of growth inhibition around the disc were measured after 24 hrs of incubation at 37°C. Each microorganism was tested in triplicate and solvent was used as a control.

### Micro dilution Method:

The method micro dilution method/technique was used to obtain quantitative data for the compounds investigated. Bacterial species were cultured overnight at 37°C in and LB medium. The inoculums suspension was adjusted with sterile saline to a concentration of approx.  $1.0 \times 10^5$  in a final volume of 100  $\mu$ l /cell. The fungal spores were washed from the surface of agar plates with sterile 0.85% saline containing 0.1% in 80 (vol. /vol.) and adjusted with sterile saline to a concentration of  $1.0 \times 10^5$  in a final volume of  $\mu$ l/ml. The inoculation was stored at 4°C for further use. Dilution of the inoculate was cultured on solid MH for bacteria and MA for fungi to verify the absence of contamination and to check the validity of the inoculums.

### Evaluated Method:

To suggest methodologists for screening the natural products' antimicrobial activity, two different

qualitative methods were evaluated by the agar diffusion test and the Bio autographic method.

#### **Agar diffusion well method:**

The bacterial inoculums were uniformly spread using a sterile cotton swab on a sterile Petri dish MH a garnon-sterile dilution yielded a concentration of 100, 80, 60, 40, 20, 10, 5, and 1.25 mg /ml. for pure substances 50 µl. of natural products were added to each of the 5 wells. The system is incubated for 24 hrs at 36°C + 1° C under aerobic conditions. After incubation confluent bacterial growth was observed. Inhibition of bacterial growth was observed and measured in mm. Agar diffusion disc method. Natural products were dissolved and diluted with solvents as mentioned previously. The same no. of subsequent diluted was performed as described above. However, natural products serial dilution was performed out of initial conc. 2.5 greater than the ones performed for the good method. 7mm filter paper dishes (No.3) were impregnated with 20ml of each of the different dilutions. The discs were allowed to remain at room temp unit for complete dilute evaporation and kept under refrigeration until ready to be used.

#### **Aseptic condition:**

An aseptic chamber that is laminar airflow was cleaned with 70% ethanol and irradiated with short-wave ultraviolet light and the empty Petri plates were sterilized in an autoclave. MH agar media were poured into plates in a sterile environment and allowed to cool at room temperature. At the same time spread 0.1 ml of a suspension of test organism on the surface of the sterile. MH agar with the help of a spreader in a zig-zag manner and wells were made with the help of a borer. Four well made in

each other. Add 100 µl. of different concentrations of plant extract in two well in each other and another one having DMSO solution and another antibiotic. Keep the plate at 37°C for incubation for at least two days to allow diffusion in extract through agar. Measure the diameter of the zone of inhibition of the test organism in presence of different plant extracts.

## **RESULTS AND DISCUSSION**

#### **Antimicrobial activity:**

The antimicrobial activity of plant extracts was tested by the good diffusion method. The antimicrobial activity of each plant extract was tested against bacterial and fungal organisms i.e. *Bacillus subtilis*, *Bacillus cereus*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *E.coli*, *Aspergillus niger*, *Aspergillus flavours* and *Fusarium spp.*

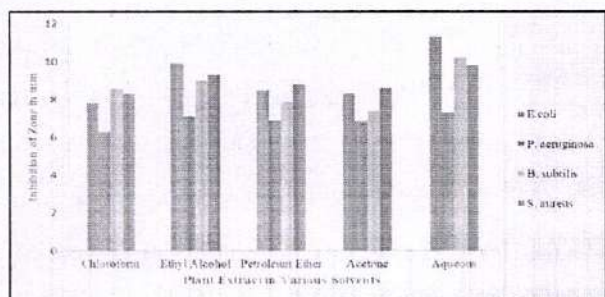
#### **Antibacterial activity:**

The seed extracts of *Sapindus trifoliatus* L. exhibited activity against *E. coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis* and *Staphylococcus aureus*. The inhibitory activity of the various seed extracts like Chloroform, Acetone, Petroleum Ether, Ethyl Alcohol and Aqueous were also observed. The chloroform extracts of *Sapindus trifoliatus* L showed less in *Pseudomonas aeruginosa* (6.03mm) and highest in *Bacillus subtilis* (8.06 mm) zones of inhibition at 100µl. The Ethyl alcohol extracts of *Sapindus trifoliatus* L showed less in *Pseudomonas aeruginosa* (7.01mm) and highest in *E.coli* (9.09 mm) zones of inhibition at 100µl. The Petroleum ether extracts of *Sapindus trifoliatus* L showed less in *Pseudomonas aeruginosa* (6.09mm) and highest in *Staphylococcus aureus* (8.08 mm) zones of

inhibition at 100µl. The Acetone extracts of *Sapindus trifoliatus* L showed less in *Pseudomonas aeruginosa* (6.09mm) and highest in *Staphylococcus aureus* (8.08 mm) zones of inhibition at 100µl. The Aqueous extracts of *Sapindus trifoliatus* L showed less in *Pseudomonas aeruginosa* (7.03mm) and highest in *E.coli*. (11.03 mm) zones of inhibition at 100µl.

**Table I: Antibacterial activity of *Sapindus trifoliatus* L.**

Sr. No.	Type of extract	Diameter of zone of inhibition(mm)			
		<i>E.coli</i>	<i>P.aeruginosa</i>	<i>B.subtilis</i>	<i>S.aureus</i>
1	Chloroform	7.8	6.3	8.6	8.3
2	Ethyl Alcohol	9.9	7.1	9	9.3
3	Petroleum Ether	8.5	6.9	7.9	8.8
4	Acetone	8.3	6.8	7.4	8.6
5	Aqueous	11.3	7.3	10.2	9.8



**Fig. No.01: Graphical Representation shows Antibacterial activity of *Sapindus trifoliatus* L. by using different extract**

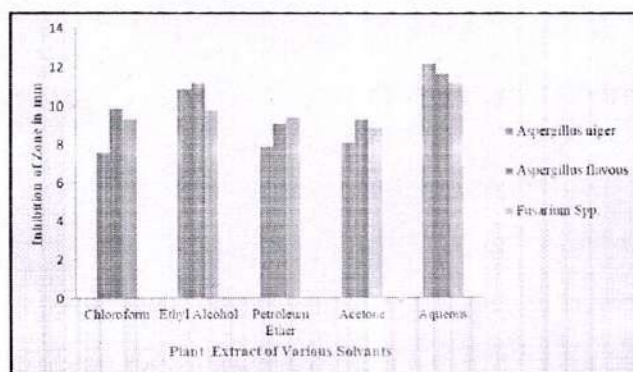
**Antifungal activity:**

The seed extracts of *Sapindus trifoliatus* L. exhibited activity against *Aspergillus niger*, *Aspergillus flavous* and *Fusarium spp.* The inhibitory activity of the various seed extracts like Chloroform, Ethyl Alcohol, Petroleum Ether, Acetone and Aqueous were also observed. The chloroform extracts of *Sapindus trifoliatus* L. showed less in *Aspergillus niger* (7.06 mm) and

highest in *Aspergillus flavous* (9.09 mm) zones of inhibition at 100µl. The Ethyl alcohol extracts of *Sapindus trifoliatus* L. showed less in *Fusarium Spp.* (9.08 mm) and highest in *Aspergillus flavous* (11.02 mm) zones of inhibition at 100µl. The Petroleum ether extracts of *Sapindus trifoliatus* L showed less in *Aspergillus niger* (7.09mm) and highest in *Fusarium Spp.* (9.04 mm) zones of inhibition at 100µl. The Acetone extracts of *Sapindus trifoliatus* L showed less in *Aspergillus niger* (8.01mm) and highest in *Aspergillus flavous* (9.03mm) zones of inhibition at 100µl. The Aqueous extracts of *Sapindus trifoliatus* L showed less in *Fusarium Spp.* (11.02 mm) and highest in *Aspergillus niger* (12.02 mm) zones of inhibition at 100µl.

**Table 2. Antifungal activity of *Sapindus trifoliatus* L.,**

Sr. No.	Type of extract	Diameter of zone of inhibition(mm)		
		<i>Aspergillus niger</i>	<i>Aspergillus flavous</i>	<i>Fusarium Spp.</i>
1	Chloroform	7.6	9.9	9.3
2	Ethyl Alcohol	10.9	11.2	9.8
3	Petroleum Ether	7.9	9.1	9.4
4	Acetone	8.1	9.3	8.9
5	Aqueous	12.2	11.7	11.2



**Fig. No.02: Graphical Representation shows Antifungal activity of *Sapindus trifoliatus* L. by using different extracts**

**CONCLUSION:**

Present study has concluded the fact that the antimicrobial activities are much more significant at *Sapindus trifoliatus* L. The seed extract of *Sapindus trifoliatus* L. species displayed inhibitory activities against the microorganisms involved in infections and skin diseases. Ethanol and Aqueous extracts of *Sapindus trifoliatus* L. Pericarp were investigated for in vitro antimicrobial screening by agar well method against *staphylococcus aureus*, *Bacillus subtilis*, *E.coli*, *Pseudomonas aeruginosa*, *Bacillus cereus*, *Aspergillus niger*, *Fusarium* spp. In the Agar well diffusion method, the highest imbibitions zone was found in aqueous extracts. It showed greater activity against the maximum tested bacteria and fungi followed by ethanol extract. The preliminary results of this study indicate that the aqueous seed extracts have the potential for antimicrobial activity.

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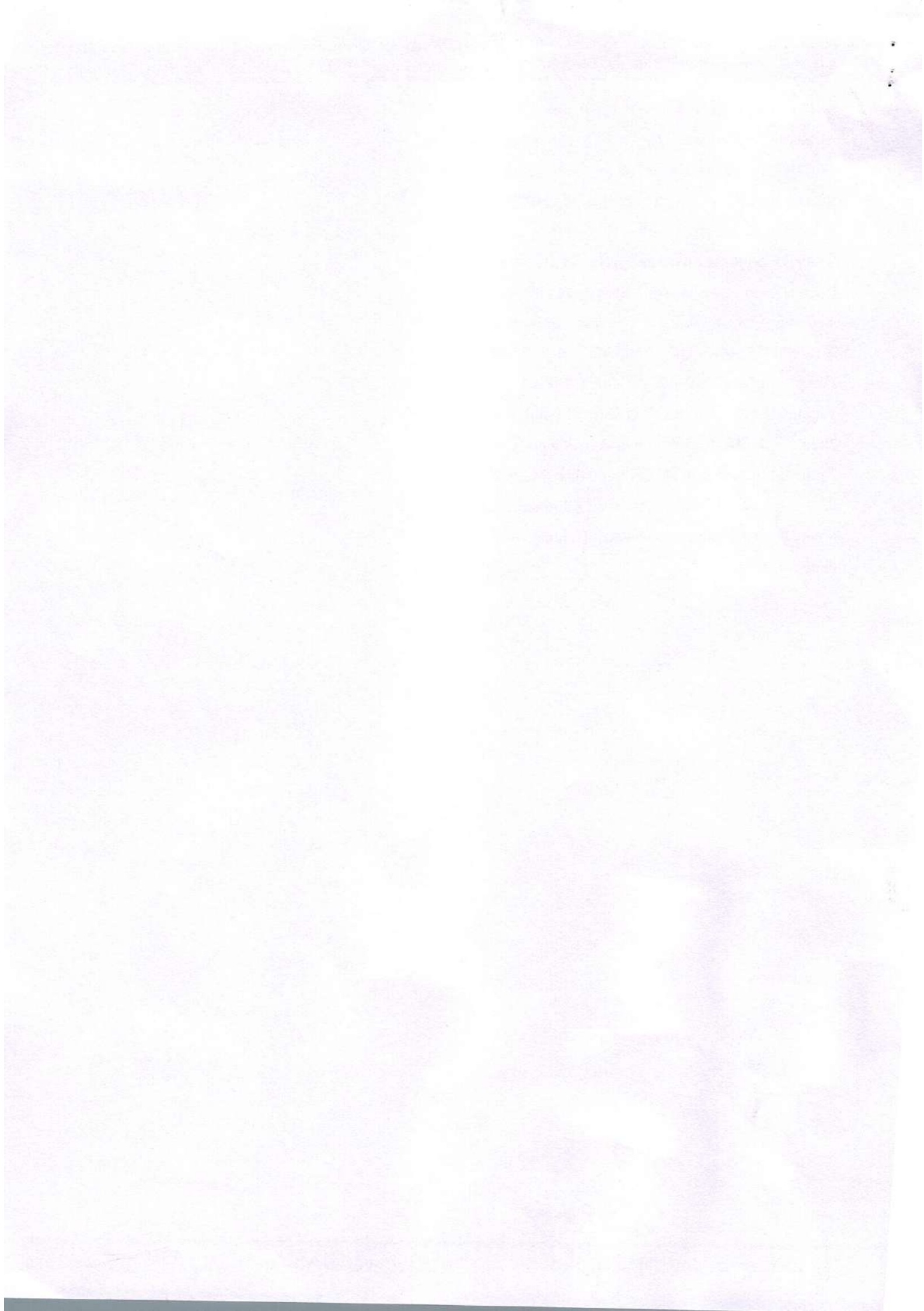
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## Integrated Pest Management (IPM) for Guava Fruit Fly

Adsul Akshay Ambadas, Adama Thanuja and Pramod Kumar

### Introduction

Guava (*Psidium guajava*) belonging to the family Myrtaceae, it's native to the American tropics, and probably originally grew from Peru north to Mexico and the Caribbean. Guava is frequently referred to as the apple of a poor man in the tropics and is known all over the globe for its delicious, enjoyable aroma and excellent dietary values (Joseph and Priya, 2011). The guava fruit has a medicinal property and excellent antioxidant source, as well as an anticarcinogenic property (Ryu *et al.*, 2012). Major guava producing states are Uttar Pradesh, Assam, Bihar, Chhattisgarh, Gujrat, Punjab, Haryana, Himanchal Pradesh, and Maharashtra. Among guava growing states, Uttar Pradesh is the major in guava production. One of the most significant pests in terms of economic impact that attacks fruits worldwide are fruit flies (Diptera: Tephritidae). *Bactrophaera* is the most economically significant genus of fruit flies, has 651 identified species, at least 50 of which are regarded as serious pests, many of which are very polyphagous. Approximately 325 species of fruit flies have been reported from India, which are occurring on different hosts. These create significant hazards to production,

affecting a variety of fruits and vegetables that are high in meat and found in tropical and subtropical regions. They result in losses that are both quantitative and qualitative. Furthermore, many fruit-producing nations have placed quarantine restrictions on the import of goods from nations infested with specific fruit fly species, and/or mandate that fruits and vegetables undergo quarantine treatment prior to their importation, due to their susceptibility to invasive tephritid species. Fruit flies are regarded as a highly favourable pest of guava fruit production inflicting yield losses and pleasant degradation of the produce. Mishra *et al.* (2012) reported a crop loss of up to Rs. 2945 crores per annum in mango, guava, sapota, and citrus in India. Since the damage done in fruit and vegetables is internal, and therefore difficult to control by the use of a single control measure. The practice of integrated pest management (IPM) is important because of its effectiveness and gains for the environment and health; otherwise the use of pesticides will keep increasing. According to Verghese *et al.* the practice of IPM to control *B. dorsalis* can give very high reductions of infestation. The array of control methods ranged from insecticide

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sprays to foliage and soil, bait-sprays, male annihilation techniques, releases of sterilized flies and parasitoids, and cultural controls can be used. Therefore, this article provides comprehensive information about Integrated Pest Management (IPM) of fruit fly.

**Biology of fruit fly:** Female fruit flies lay eggs on the surface of host fruits. After that eggs hatch into maggots/larvae. First instar larvae are very small and delicate. Second instar larvae are slightly more robust and third instar larvae are quite stout and tough. After finishing feeding third instars leave the decaying host fruits, fall on the ground, and crawl into the soil for pupation. After that larval skin gets hard, become tanned brown and barrel-shaped which is called 'as the puparium. Inside that puparium, true pupa will form, pupa turns into an adult fly. Adult fruit fly splits open the anterior end of the puparium and escapes from the puparium by squeezing out. They may have multiple generations in a year depending on the host availability.

**Nature of Damage:** When the female fruit fly pierces fruit with her long, thorny ovipositor to lay eggs, the infestation starts. Fruit sustains damage to its skin, develops a secondary infection, and eventually begins to rot. After hatching from the egg, the maggot feeds on the decomposing fruit tissue, which is a breeding ground for bacteria and yeasts. During the process of egg laying, small depressions are seen on the fruits. The damaged part of the fruit becomes soft at the place of larval feeding and later on leads to putrefaction, and subsequently fruit drop

occurs. In peninsular India the infestation level of *B. dorsalis* varies from 10 to 41% on different cultivars of guava (Reddy and Vasuki, 2002).

**Integrated Pest Management (IPM):** The problems of pest control and concern about the indiscriminate use of pesticides in our environment have been the subject of intense debate and discussion. There has been tremendous pressure to devise other methods of pest control that reduce the dependency on synthetic pesticides and reduce residue levels in food commodities. An overarching system that reduces the usage of pesticide is integrated pest management (IPM) that implies to grow high quality produce with minimal impact on human health and environment while providing high economic returns. An integrated strategy for crop pest management includes use of resistant varieties, modifying agronomic practices to reduce pest incidence, biological control and other novel approaches for pest suppression, and only need-based and judicious use of chemical pesticides.

**Cultural control:** Manipulation of farming practices for reducing or preventing pest damage to crops is known as cultural control. It is based on habitat management and requires a thorough understanding of different components of the Agro-ecosystem in which the pests flourish. It is also known as ecological management or environmental management.

**Early harvesting:** When fruits are harvested early, they can help prevent infestations. For example, fruit flies that target almost-ripe fruits may not assault

small, green, unharvestable fruits. Harvesting crops at a mature stage when the fruit or vegetable is not vulnerable to fruit fly attack can help prevent fruit fly infestation.

**Crop sanitation:** Cleaning and maintenance of hygiene are essential around fruit trees, significantly contribute to the reduction of fruit fly population in the orchard. The collection and destruction of fallen, infested and overripe fruits are strongly recommended to reduce the resident population of fruit flies. Fruit fly eggs and maggots may not develop in contaminated fruit if the area is kept clean. By destroying the fruit, you may be sure that the maggots won't make it to the ground where they will pupate before becoming adult flies.

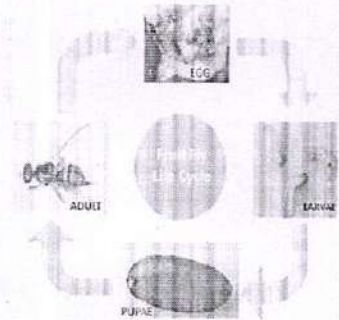
**Soil raking:** Raking of soil around the guava trees can be done for effective destruction of pupal inoculation during the summer season. The residual pupae are the major source of the infestation.

**Mechanical control:** Bagging of fruits during development can reduce the chances of physical damage, improve color at harvest. The best method for controlling guava fruit flies was to wrap each fruit in a transparent polypropylene (20 $\mu$  gauge) bag and place a piece of paper inside the bag for partial sunlight coverage. It completely protects fruits from flies and prevents fruit flies from laying eggs. Sterile males are released in a large number to mate with wild females (Knipling, 1959). Sterilization is accomplished through irradiation, chemosterilization, or by genetic manipulation in selected males of fruit flies. In sterile insect programs, the terms

'sterility' or sterile insect' refers to the transmission of dominant lethal mutations that kill the progeny. It is one of the excellent tactics to suppress reproduction. The control of fruit flies at the destructive larval stage is difficult because insecticides in the form of dust or sprays cannot reach till target maggots.

**Biological control:** Fruit flies' natural enemies should be preserved in farms and orchards because they can aid in their management. Utilizing natural enemies is more affordable, sustainable, and safe. The most prevalent class of parasitoids that are commonly employed against fruit flies is *Opines* spp. The juvenile fruit fly larvae that are feeding beneath the fruit's skin are being parasitized by these larval parasitoids.

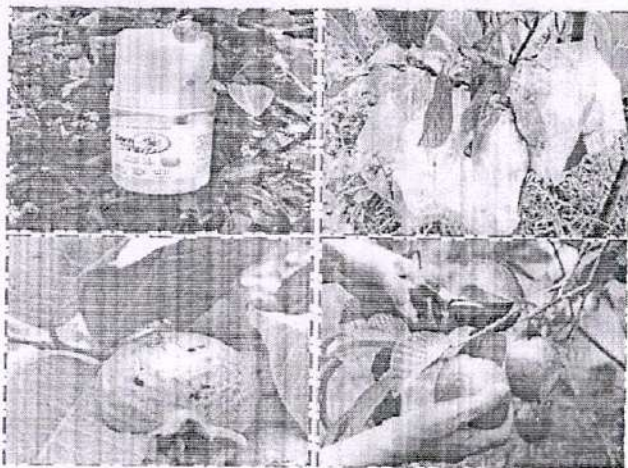
**Chemical control:** The use of a single control measure such as insecticides can not give a total reduction of fruit flies infestation since the damage done by larvae in fruit and vegetables is internal, and therefore difficult to control. Sunil *et al.* (2016) evaluated that Delta methrin 2.8EC in combination with Jaggery (0.0028 + 0.015 %) gave the best control against Melon Fly in Bitter Gourd. Khomane *et al.* (2023) revealed that the results showed that treatment with wrapping of fruits with foam and bag followed by Spinosad 45% SC @ 0.4 ml l<sup>-1</sup> followed by Flubendamide 8.83% + Deltamethrin 5.56% SC @ 0.5 ml l<sup>-1</sup> was found to be



most effective and recorded maximum reduction over control.

### Conclusion

Given the significance of both crops and pests, growers prioritize management in order to maximize the yield from their guava orchards. A variety of control techniques are used to raise the guava produce's quality and output. The fruit fly can travel great distances and has a broad host range, thus any control method that is implemented on an area-wide basis will be more successful. The community should use the IPM module in conjunction with a variety of control strategies, such as early harvesting, fruit wrapping, field cleaning, raking, trapping. In guava orchards, the fruit fly population can be effectively managed by the use of combinations measures.



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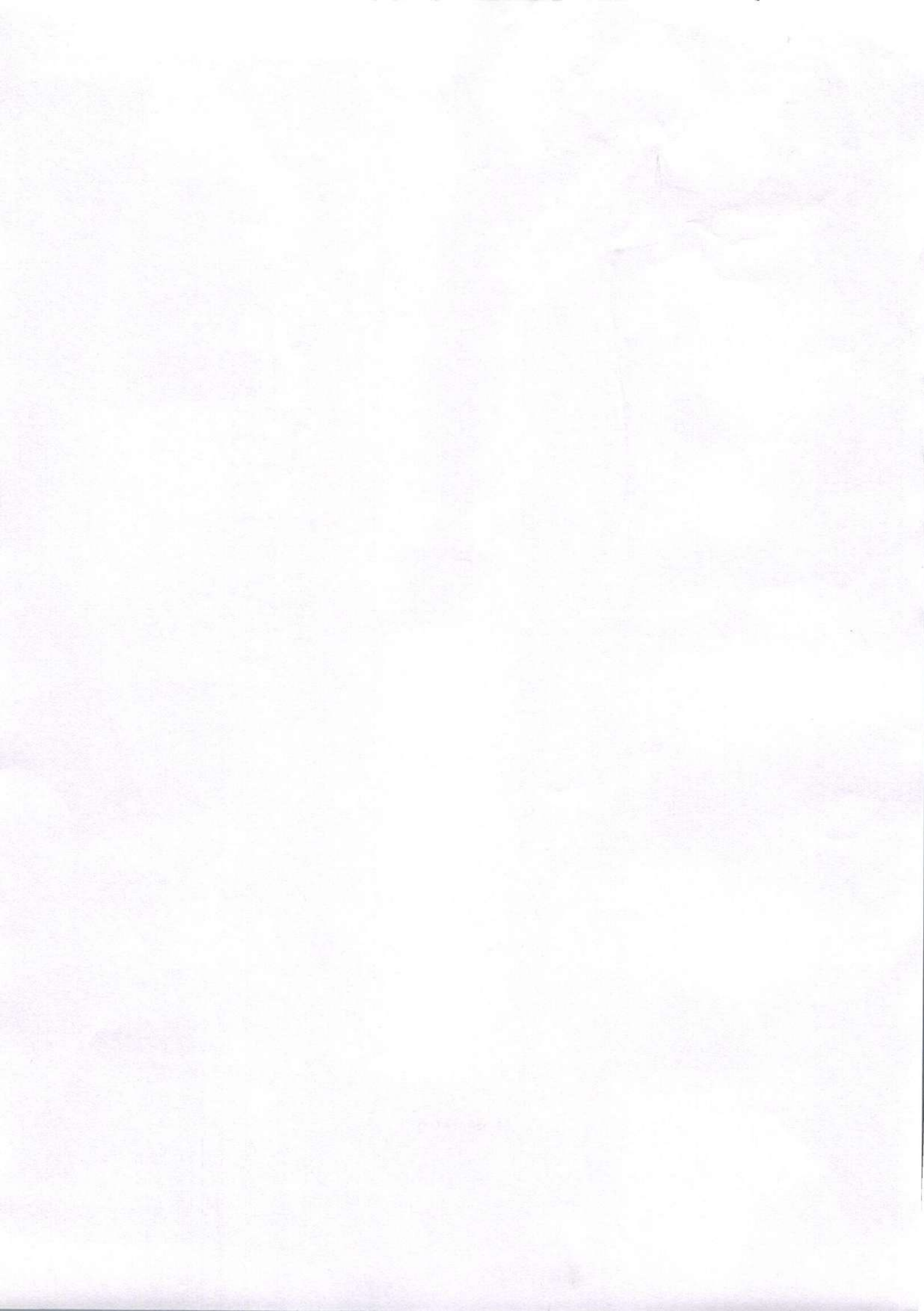
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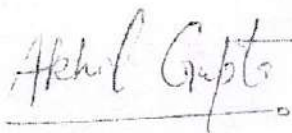
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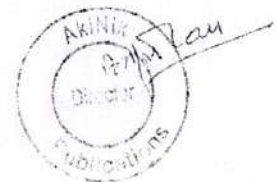
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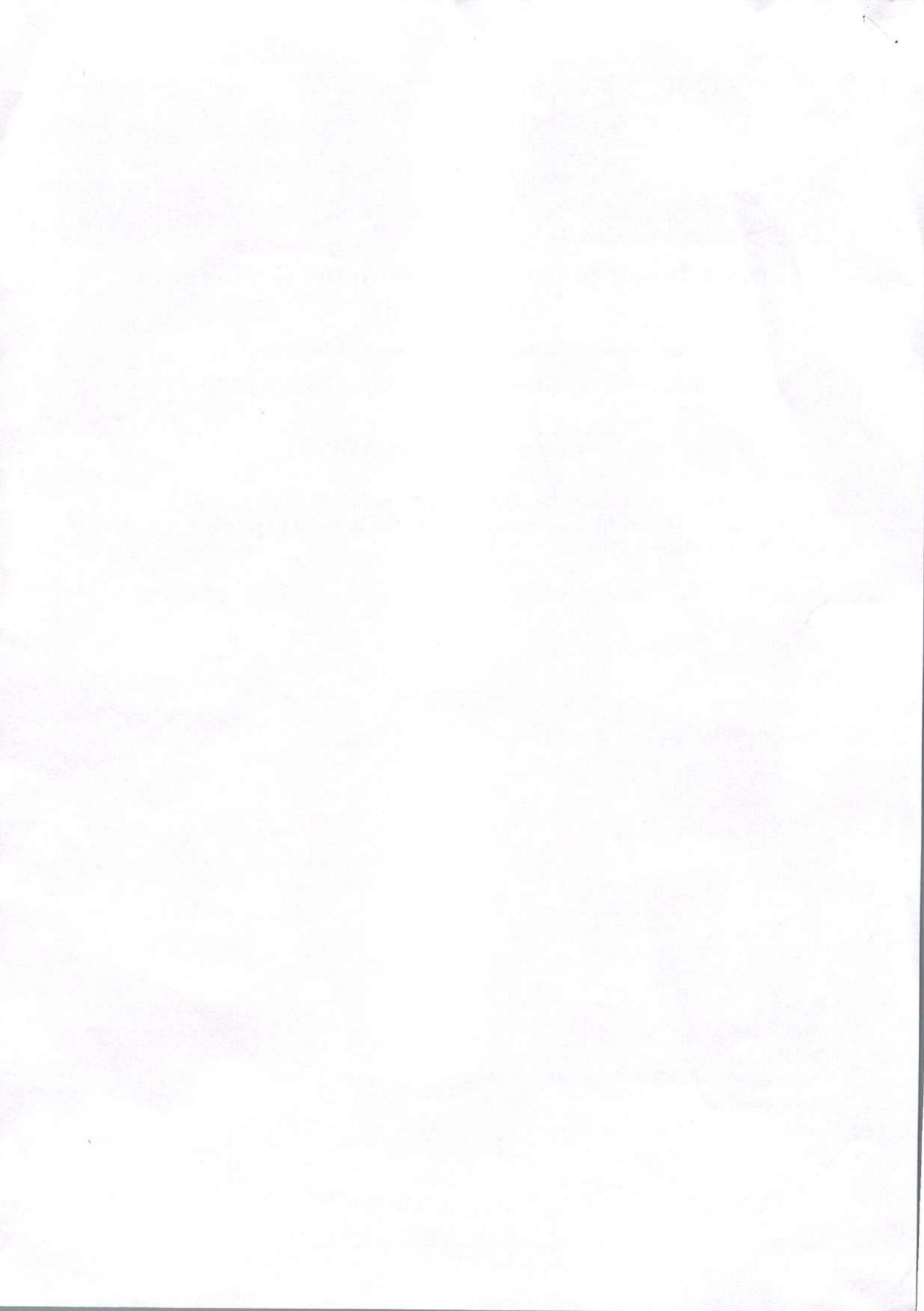
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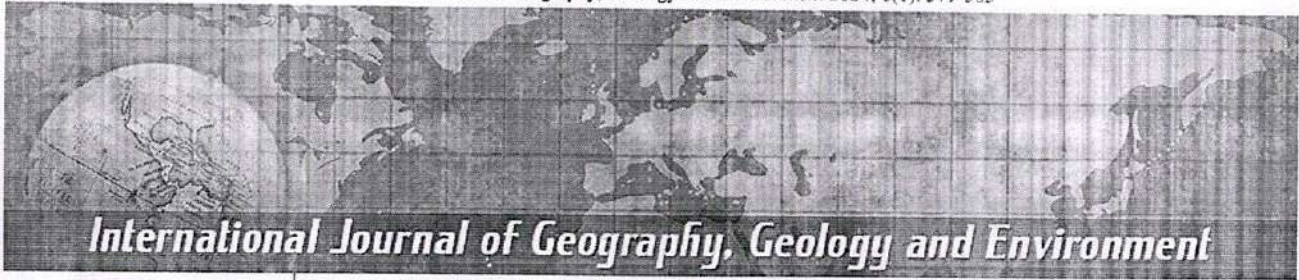
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## To study the cost-benefit analysis of cash crops in Sangamner tehsil of Ahmednagar district (MS)

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### Abstract

The present research paper study and analyze the Cost-benefit analysis of cash crops at the macro level in Sangamner tehsil. This study is based on primary and secondary data collected from farmer's revenue records and district gazetteer offices. Cash crop production depended on physical, climate, socio-cultural, economic, technological and organizational factors. The Sangamner tahsil covers 135780 hectares of land and has a population of 487939 in 171 villages as per the 2011 Census. The primary crops under consideration include Sugarcane, Onion, Vegetables and fruits, each analyzed in terms of various farming operations, labor, and input costs. The cost-benefit analysis for irrigated Onion showed a profit of Rs. 328200 per hectare. For irrigated Sugarcane, the profit was Rs. 285700 per hectare. The cash flow analysis revealed the percentage of cash outflows and inflows for each type of crop, helping to understand the income distribution and costs involved.

**Keywords:** Cash crops, cash in flow, cash outflow, cost benefit analysis

### Introduction

The dominant cropping pattern in the tahsil is discussed in the research paper. At this juncture, it seems that the Cost-Benefit analysis of the various crops being grown in the tahsil can provide more insight into the problems faced by the farmers. The cost-benefit analysis was carried out based on the sample survey information. The research paper is mainly devoted to discussing the problems of agriculture and farmers in the tahsil as understood by the primary survey. The survey provides information on parameters related to agricultural benefits and production costs by the current cropping pattern. This and a similar kind of database are used to understand and analyze the spatial distribution.

In the last few years, in various geographical studies, cost-benefit analysis techniques have been used by various geographers and these techniques are enormously useful for the study of agricultural geography, such as Prest and Turvey (1965) [13], Joshi (1985) [14], Saptarshi and Bairagi (1998) [1] and Saptarshi and Bhagat (2004) [15]. The efficient use of available water resources based on technology (Bhagat 2002, and Sonawane 2013) [16, 17], current employment status in rural areas (Jagdale, 2002) [18], assessment of human resource development (Ugale, 2006) [19], a strategy for sustainable development of agriculture, human resource development (Musmade, 2012) [20], cost-effective use of water resources (Sonawane, 2013) [16] and a strategy for groundwater management for sustainable development of agriculture (Chavan, 2014) [21]. The present study aims to find out the availability of water resources for the sustainability of agriculture in the Sangamner tahsil. Hence, the cost-benefit analysis of major cash crops in the tahsil has been carried out. For this, the primary data was collected from at least 100 farmers cultivating each selected crop in the tahsil based on the questionnaire. The sample points have been selected in such a way that they will be well distributed among the villages of the tahsil in a circle-wise manner. Thus, after analyzing the basic database collected from the primary sources, the average values of the price of each crop are obtained. Comprehensive information regarding expenditure is given in the table Table No. 1 to Table No. 16.

### Study Area

Sangamner tehsil is located in the western part of Ahmednagar district in the state of Maharashtra. Sangamner is surrounded by Rahata, Rahuri and Kopergaon to the east.

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Sinner tehsil Nashik District to the North. Akole tehsil to the west. Sangamner tehsil to the south-east, Junner tehsil Pune district to the south. The Tehsil 'Sangamner' is located middle part of the bank of the Pravara river. This lies between 19°34' North 19.57° North to 74°13' East 74.22° East longitude. It has an average elevation of 549 metres (1,801 ft) from mean sea level Sangamner tehsil is located in the western part of Ahmednagar district. The highest peak, as well as the temple of this tehsil, is Baleshwar. Baleshwar is located in Harichandra Range 15 km from Sangamner tehsil headquarters. Physiography, rainfall, soil, temperature, and drainage influence agricultural land use patterns in this tehsil. Rainfall varies between 200 to 225 mms. The underlined basalt on disintegration and decomposition brought various agents that had yielded three kinds of soils viz. Deep black, deep & shallow Alluvial soils in Pravara, Mhalungi and Adhula river basins. These rivers are the main irrigation source of middle tehsil areas. Including five centers of Revenue Circle i.e. Sangamner, Ashwi, Talegaon, Ghargaon and Sakur. The rainfall is mainly due to rain shadow area in terms of the amount of rainfall average receives 416.6 millimeters in the western and middle parts of the tehsil but in the southern part of the tehsil 102 villages are drought-prone areas. Therefore these areas are mostly hilly and unirrigated. The variation in the amount of rainfall & type of soil exerts influence on the cropping pattern of the study region. The major crops namely cereals, cash crops, pulses, oil seeds, fruit crops, vegetables, flower and fodder crops are cultivated in Sangamner tehsil.

#### Objective

To study the Cost Benefit Analysis for cash crops in Sangamner Tehsil Ahmednagar District of Maharashtra.

#### Database and Methodology

The study is based on secondary data and field observations. Circle-wise crop data is obtained from village officers' (Talathi) records, APMC Market and Panchayat Samities records in Sangamner tehsil. Topographical maps and survey of India sheets are used for the physiographical study. Landuse data collected from the socio-economical abstract and Ahmednagar gazetteer and district census handbook in Ahmednagar district referred to collect related information.

#### Methodology

The 171 villages were divided according to 14 Revenue Circles. Information from more than 100 farmers from selected villages in 14 circles of the tehsil has been

collected. Well distributed to 14 villages randomly selected according to crop to collect primary information. Expenditure incurred for various operations like tillage, fertilizer, seed, planting, weeding, harvesting, etc. is considered as final charges. A summary of various operations has prepared to understand the cost per hectare for each major crop in the tehsil.

First of all, the cost of major cash crops in the tehsil has been taken into consideration. The first step is to identify the major cash crops in the tehsil. The major cash crops grown are mainly Onion and Sugarcane. Out of the net sown area in the tehsil, only 25.74% of NSA is under irrigation. The highest irrigated area is 58.32% under Well irrigation, Canal 20.43%, Tube well 3.75%, and River 17.50%.

#### Cost Structure

To understand the cost of each crop based on a sample survey in randomly selected 8.18% of villages, A structured questionnaire has been developed to find out the cost of various operations ranging from planting to harvesting and selling in the market.

#### Cash Flow Analysis

The total income of the farmer has been analyzed to understand the cash flow after getting the statistics of expenditure on the cultivation of major crops in the study area. This type of cash flow analysis has been done in research over the last few decades (Saptarshi and Kale 1984, Sonawane 2013 and Chavan 2014) [22, 16, 21]. This technique is very useful to understand the economic system as a whole. In the present study, the following factors have been considered to cover the cost of cash flow.

#### Cash in Flow

1. Wages are given to women worker
2. Wages are given to the male worker
3. Profit margin earned by cultivators.

#### Cash-out Flow

1. Cost of seeds, fertilizers, and pesticides
2. Cost of packing material brought from the urban sector
3. Cost of fuel such as electric bill, diesel or hiring tractor, and technology

Thus, the share of income that remains in the tehsil and the share that goes out of the tehsil estimated based on expenditure structure. This research has estimated for each village and the tehsil.

#### Cost of Onion Crop Cultivations

Table 1: Cost of Onion Cultivation

Sr. No.	Operations	Human Power		Labour Cost			Other Cost Rs.	Total Cost Rs.	Per Cent (%)
		Man Days	Women Days	Male Rs.	Female Rs.	Total Rs.			
1	Ploughing	02	00	800	00	800	3000	3800	02.21
2	Harrowing	04	00	1600	00	1600	4500	6100	03.55
3	Sowing / Seedling	05	40	2000	12000	14000	5000	19000	11.06
4	Cost of Seeds	00	00	00	00	00	12500	12500	07.28
5	Electricity Charges	00	00	00	00	00	3000	3000	01.75
6	Fertilizers/ Pesticides	10	00	4000	00	4000	75000	79000	45.98
7	Weeding	00	30	00	9000	9000	2000	11000	06.40
8	Irrigation	25	00	10000	00	10000	00	10000	05.82
9	Harvesting	10	30	4000	9000	13000	5000	18000	10.48
10	Threshing	00	00	00	00	00	00	00	00.00

11	Packing	06	20	2400	6000	8400	1000	9400	05.47
	Total	62	120	24800	36000	60800	111000	171800	100.00

Source: Field Survey Data (2022-2023).

As discussed in the Onion crop is cultivated in the tahsil during Rabbi and Kharip Season. In the above Table No.1 indicates, the cost of various operations in the field of Onion cultivation has calculated. The figures in the table show that the average total production cost of Onion cultivation is Rs. 171800/-. The total average cost of labor is Rs. 60800/- while the other total expenditure is Rs. 111000/-. The cost structure of the Onion crop shows that most of the cost in various operations is on fertilizers, pesticides seeds, packing, sowing, and harrowing.

Table 2: Output of Onion Cultivation

Sr. No.	Details	Rupees
1	On-farm Price/Kg. Rs.	Rs.20.00/-
2	Grain Production/Hector Kg.	25000 Kg.
3	Grain Production/Hector Rs.	Rs.500000/-
4	Average on-farm price of fodder/Hector Rs.	Rs.00/-
5	Total Earnings/Hector (Grains + Fodder)	Rs.500000/-
6	Total Cost/Hector	Rs.171800/-
7	Net Profit/Hector (Total Earning - Total Cost)	Rs.328200/-
8	Man Days/Hector	62 Days
9	Women Days/Hector	120 Days
10	Daily wages for male workers	Rs.400/-
11	Daily wages for female workers	Rs.300/-

Source: Field Survey Data (2022-2023).

The Table No. 2 indicates that the cost of Onion cultivation is Rs.171800/- per hect. and the net output from the Onion cultivation is Rs.500000/- per hect. The net benefit from the Onion cultivation is Rs.328200/- per hect. The field observation and statistical data show the requirement of employment per hect. Onion cultivation is 62 males and 120

females. In the tahsil during 2022-23, the area under Onion cultivation is 10795 hect. The employment power requirement and generated is 669290 male days and 1295400 female days workers in the tahsil.

Table 3: Cash Flow Analysis of Onion Cultivation

Sr. No.	Cash Flow Analysis	Rupees	Percentage (%)
1	Cash Out-flow	60800	12.16
2	Cash In-flow	111000	22.20
3	Profit	328200	65.64
	Total Income	500000	100.00

Source: Field Survey Data (2021-2022).

It is observed that the profit earned by the farmer due to the cultivation of Onion is about 65.64% (Table No. 3). The cash inflow in the case of Onion is 22.20%. The cash out-flow in Onion cultivation is 12.16%. It shows most of the onion production goes inside the tahsil. Therefore, the tahsil benefits high from onion production as compared to other crops.

#### Cost of Sugarcane Cultivation

In the above Table No. 4 indicates, the cost of various operations in the field of Sugarcane cultivation has calculated. The figures in the table show that the average total production cost of Sugarcane cultivation is Rs. 119300/- per hect. The total average cost of labor is Rs. 36300/- while the other total expenditure is Rs. 83000/-. The cost structure of Sugarcane crops shows that most of the cost in various operations is on pesticides, fertilizers, seeds, irrigation, and sowing.

Table 4: Cost of Sugarcane Cultivation

Sr. No.	Operations	Human Power		Labour Cost			Other Cost Rs.	Total Cost Rs.	Per Cent (%)
		Man Days	Women Days	Male Rs.	Female Rs.	Total Rs.			
1	Ploughing	02	00	800	00	800	5000	5800	04.86
2	Harrowing	02	00	800	00	800	7000	7800	06.54
3	Sowing/Seedling	20	00	8000	00	8000	2000	10000	08.38
4	Cost of Seeds	00	00	0	00	00	20000	20000	16.76
5	Electricity Charges	00	00	0	00	00	9000	9000	07.54
6	Fertilizers/ Pesticides	15	05	6000	1500	7500	30000	37500	31.43
7	Weeding	04	00	1600	00	1600	10000	11600	09.72
8	Irrigation	44	00	17600	00	17600	00	17600	14.75
	Total	87	05	34800	1500	36300	83000	119300	100.00

Source: Field Survey Data (2020-2021).

Table 5: Output of Sugarcane Cultivation

Sr. No.	Details	Rupees
1	On-farm Price/Kg. Rs.	Rs.2.70/-
2	Grain Production/Hector Kg.	150000 Kg.
3	Grain Production/Hector Rs.	Rs.405000/-
4	Average on-farm price of fodder/Hector Rs.	Rs.00/-
5	Total Earnings/Hector (Grains + Fodder)	Rs.405000/-
6	Total Cost/Hector	Rs.119300/-
7	Net Profit/Hector (Total Earning - Total Cost)	Rs.285700/-
8	Man Days/Hector	87 Days
9	Women Days/Hector	5 Days
10	Daily wages for male workers	Rs.400/-
11	Daily wages for female workers	Rs.300/-

Source: Field Survey Data (2022-2023).

The Table No. 5 indicates that the cost of Sugarcane cultivation is Rs.119300/-per hect. and the net output from the Sugarcane cultivation is Rs.405000/- per hect. The net benefit from the Sugarcane cultivation is Rs.285700/- per hect. The field observation and statistical data show the

requirement of employment per hect. Sugarcane cultivation is 87 males and 05 females. In the tahsil during 2022-23, the area under Sugarcane cultivation is 13930 hect. The employment power requirement and generated is 1211910 male days and 69650 female days workers in the tahsil.

**Table 6: Cash Flow Analysis of Sugarcane Cultivation**

Sr. No.	Cash Flow Analysis	Rupees	Percentage (%)
1	Cash Out-flow	83000	20.49
2	Cash In-flow	36300	08.96
3	Profit	285700	70.54
	Total Income	405000	100.00

Source: Field Survey Data (2022-2022).

Sugarcane is a good cash crop grown mainly in the southern part of the tahsil and is highly profitable (70.54%). However, cash flow analysis has caught the attention of current workers as cash-outflows (20.49%) and cash-inflows

(08.96%) are almost identical or have very little difference.

#### Cash Flow Analysis

**Table 7: Cash Flow Analysis**

Sr. No.	Operations	Cash- Out Flow	%	Cash- In Flow	%	Profit	%	Total Income	%
1	Sugarcane	60800	42.28	111000	75.36	328200	53.46	500000	55.25
2	Onion	83000	57.72	36300	24.64	285700	46.54	405000	44.75
	Total	143800	100.00	147300	100.00	613900	100.00	905000	100.00

Source: Field Survey Data (2022-2023).

The cash flow analysis technique is very useful for understanding the crop-wise rupee incoming and outgoing in tahsils. The cash flow analysis of cash crops in the study area was revealed in Table No. 7. The cash-out flow is observed higher in the crops is Onion (57.72%) and lower the Sugarcane (42.28%). Also, the cash out flow is higher in the case of crops like Sugarcane (75.36%). The profit is higher in the case of crops like Sugarcane (53.46%).

#### Conclusion

The research paper discusses the dominant cropping pattern in Sangamner tahsil, Maharashtra, focusing on cost-benefit analysis and agriculture-related problems. The study aims to understand the sustainability of agriculture by analyzing the cost-benefit of major cash crops in the region. Data was collected from over 100 farmers in a sample survey distributed across the villages in the tahsil. The primary crops under consideration are Sugarcane and Onion, and the study distinguishes between irrigated variants of these crops.

#### Onion

The total cost of irrigated Onion cultivation is Rs. 171800 per hectare, while the total earnings per hectare are Rs. 500000. This results in a net profit of Rs. 328200 per hectare. Employment requirements include 62 male and 120 female workdays per hectare. The study estimates that in 2022-23, 10795 hectares were cultivated with irrigated Onion, generating employment for 669290 male and 1295400 female workers in the tahsil. The cash flow analysis shows that cash inflow is 22.20%, cash outflow is 12.16%, and the profit is 65.64%.

#### Sugarcane

The total cost of irrigated Sugarcane cultivation is Rs. 119300 per hectare, while the total earnings per hectare are Rs. 405000. This results in a net profit of Rs. 285700 per hectare. Employment requirements include 87 male and 05

female workdays per hectare. The study estimates that in 2022-23, 13930 hectares were cultivated with irrigated Sugarcane, generating employment for 1211910 male and 69650 female workers in the tahsil. The cash flow analysis shows that cash inflow is 08.96%, cash outflow is 20.49%, and the profit is 70.54%.

In summary, the research paper provides a detailed cost-benefit analysis of various cash crops in Sangamner tahsil, highlighting the profitability and employment generation associated with different crops and irrigation practices.

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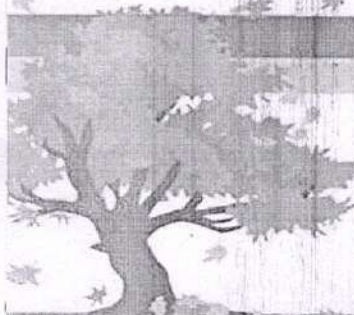
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# THE USE OF ARTIFICIAL INTELLIGENCE IN LIBRARY MANAGEMENT

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**Abstract:** This research paper explores the applications and benefits of Artificial Intelligence (AI) in library management systems. With the rapid advancements in technology, libraries are embracing AI to enhance their operations, improve user experiences, and optimize resource utilization. This paper provides an overview of AI technologies employed in library settings, discusses their impact on various library functions, and highlights the challenges and considerations associated with their implementation. The findings suggest that AI has the potential to revolutionize library management, empowering librarians to deliver efficient services and empowering users with enhanced access to information resources.

**Index Terms – Artificial Intelligence, Library Management.**

## 1. Introduction:

Libraries serve as custodians of knowledge, connecting users with valuable information resources. However, the increasing volume and complexity of information pose significant challenges for librarians in managing collections, providing efficient services, and meeting user expectations. This has led to the exploration and adoption of AI technologies to revolutionize library management practices. AI offers the potential to automate repetitive tasks, enhance resource discovery, personalize user experiences, and enable data-driven decision-making. This paper examines the applications and impact of AI in library management, shedding light on its transformative capabilities.

## 2. AI Applications in Library Management:

### 2.1 Information Discovery and Recommendation:

AI-powered algorithms can analyse user preferences, historical data, and contextual information to provide personalized recommendations, enhancing the discovery and retrieval of relevant resources. These recommendation systems can suggest books, articles, or multimedia materials based on users' reading history, interests, and user profiles, thus improving user satisfaction and engagement.

### 2.2 Cataloguing and Metadata Enhancement:

AI techniques, such as natural language processing (NLP) and machine learning, can automate the process of cataloguing and metadata creation. By analysing textual content and extracting relevant information, AI can enhance the accuracy and efficiency of cataloguing tasks, ensuring consistent and enriched metadata for library resources.

### 2.3 Chatbots and Virtual Assistants:

AI-powered chatbots and virtual assistants can offer real-time assistance to library users. These automated systems can handle routine inquiries, provide information on library services and policies, assist with basic research queries, and offer guidance on resource discovery, freeing up librarians' time for more complex tasks and personalized interactions.

### 2.4 Collection Management and Preservation:

AI technologies, including image recognition and text analysis, enable efficient collection management and preservation. Automated systems can analyse the condition of physical materials, identify damaged items, suggest appropriate preservation techniques, and facilitate the digitization of rare or fragile materials.

### 3. Impacts and Benefits:

#### 3.1 Enhanced User Experience:

By leveraging AI technologies, libraries can offer personalized services tailored to individual users' needs. Intelligent recommendation systems, chatbots, and virtual assistants provide seamless and user-friendly experiences, enabling users to navigate through vast collections, find relevant resources, and obtain timely assistance.

#### 3.2 Improved Operational Efficiency:

AI automates labour-intensive tasks, reducing the time and effort required for cataloguing, inventory management, and circulation processes. This enables librarians to focus on more strategic activities, such as curating collections, designing user-centric services, and conducting research.

#### 3.3 Data-Driven Decision Making:

AI facilitates data analysis and generates insights that inform evidence-based decision-making. By analysing user behaviour, resource usage patterns, and trends, libraries can optimize collection development, tailor services, and allocate resources effectively.

### 4. Challenges and Considerations:

#### 4.1 Ethical Considerations:

The use of AI in library management raises ethical concerns, such as data privacy, bias in algorithms, and the responsibility of preserving intellectual freedom. Libraries must ensure transparent and ethical use of AI technologies, safeguarding user privacy and upholding ethical principles.

#### 4.2 Skillset and Training:

Implementing AI requires librarians to acquire new skills and expertise in areas such as data analytics, machine learning, and natural language processing. Libraries must invest in training programs to equip their staff with the necessary competencies to harness the potential of AI effectively.

#### 4.3 Accessibility and Inclusivity:

AI systems should be designed with accessibility and inclusivity in mind. Libraries must ensure that AI-powered solutions are usable by all users, including those with disabilities, and that bias and discrimination are minimized in the algorithms and data used.

### 5. Conclusion:

The integration of AI technologies in library management systems presents tremendous opportunities to transform library operations, enhance user experiences, and optimize resource utilization. By embracing AI, libraries can deliver personalized services, streamline processes, and leverage data for evidence-based decision-making. However, careful consideration of ethical implications, staff training, and accessibility is necessary to ensure the responsible and equitable implementation of AI in library settings. As technology continues to evolve, libraries must adapt and innovate to remain vital in the digital age, harnessing the power of AI to serve their users effectively.

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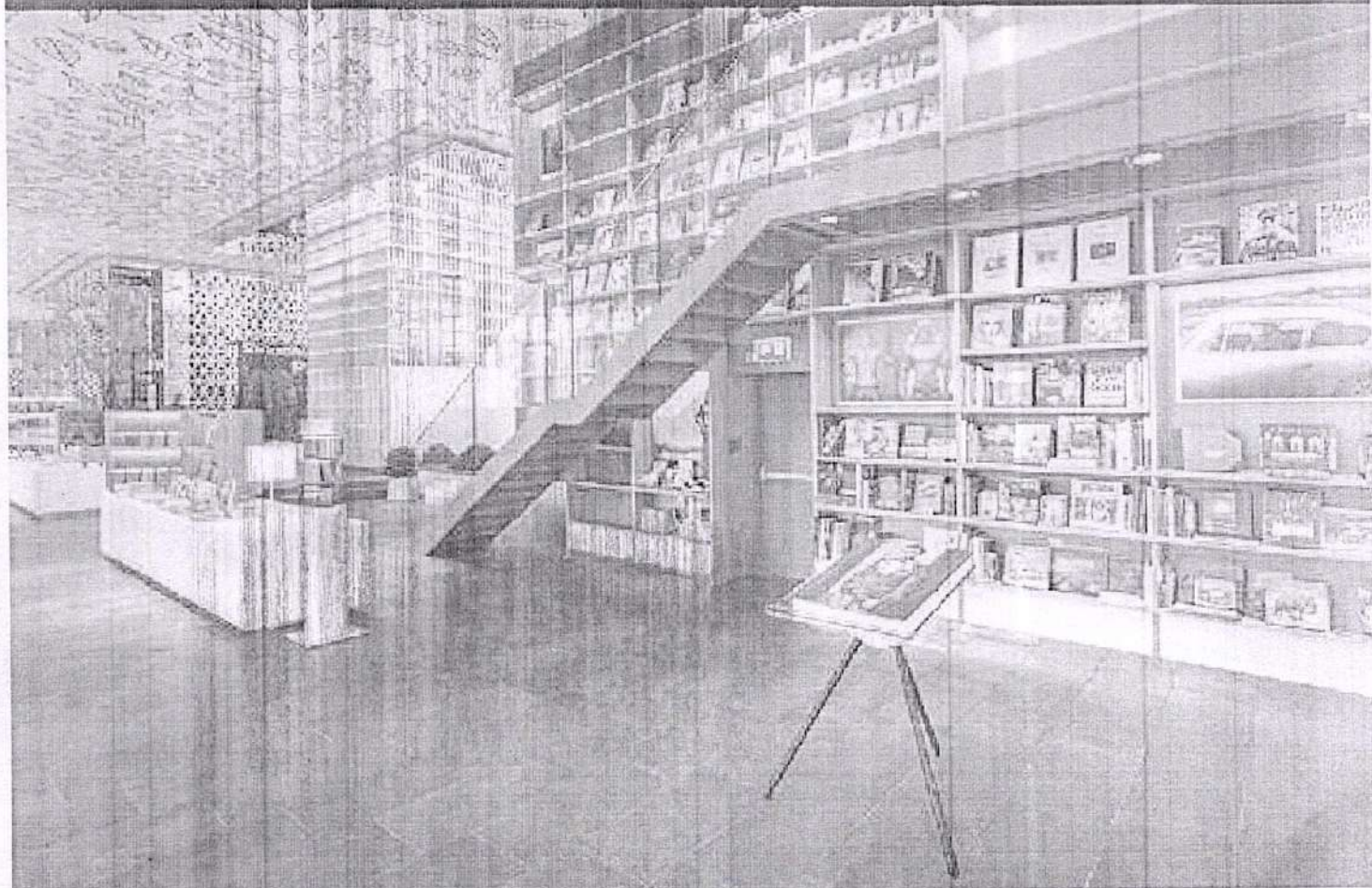
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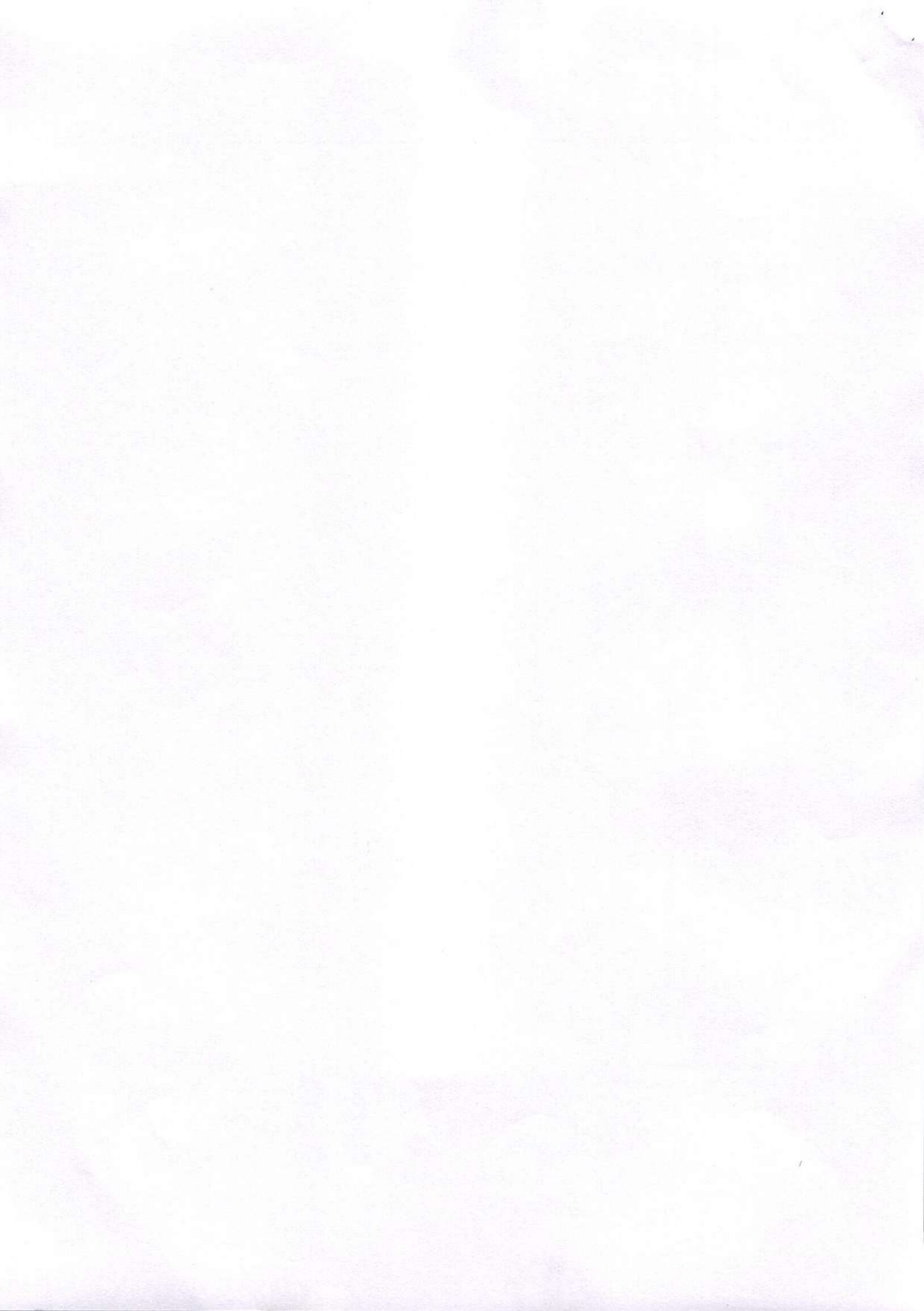
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Convener



## Chapter 65

# Exploring HR Practices in Academic Libraries: Challenges and Strategies for Success

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## Chapter

### ABSTRACT

*The human resources function plays a crucial role in the effective functioning of any institute. An academic library is a specialized library within an educational institution, such as a university or college, that serves as a vital resource hub. Well-trained staff always help to enhance the quality of the organization's services. HRM plays a crucial role in appointing staff, professional development of staff, their engagement in planning operations, guidance in performing the task, etc. The nature of Human Resource Management (HRM) in a library is characterized by its unique considerations and specific requirements. These requirements and considerations are also mentioned by the researcher in this paper. Also, the researcher mentions the types of human resources in the library, challenges and human resources management strategies.*

### Introduction

The heartbeat of any institution is the library (Misban 2016, Akpoghome 2019). The human resources function plays a crucial role in the effective functioning of academic libraries. As information centers within educational institutions, academic libraries rely on skilled and dedicated staff to provide quality services and support to faculty, students, and researchers. The introduction of HR practices in academic libraries is essential for managing the library workforce, addressing various challenges, promoting professional development, ensuring diversity and inclusion, and aligning HR strategies with the library's mission and goals.

Libraries at colleges and universities provide a challenging environment for the practice of human resource (HR) administration. The dynamics and structure of the academic library within the higher education community create complex environments

for the library administrator attempting to navigate the myriad rules and regulations (state, federal, and institutional) that affect staff recruiting, hiring, processing, compensating, and related functions for library personnel. (Defa, Dannis 2008).

Personnel management in libraries is an aspect of library administration that involves planning for human resource needs such as recruitment, selection, human resource development, motivation, performance appraisal. (Ukwoma,2008)

### **Concept of Academic Library**

An academic library is a specialized library within an educational institution, such as a university or college, that serves as a vital resource hub for students, faculty, researchers, and staff. Its primary purpose is to support teaching, learning, and research activities by providing access to a wide range of scholarly resources, including books, journals, databases, multimedia materials, and digital resources. Academic libraries offer a conducive environment for studying, research, and collaboration, equipped with various study spaces, computer labs, and access to technology. They play a crucial role in promoting information literacy skills, assisting users in locating and evaluating information, and providing expert guidance on research methodologies. Academic libraries also serve as cultural and intellectual centers within the academic community, hosting events, exhibitions, and lectures, and fostering a sense of academic community and intellectual exploration.

### **Concept of Human Resource Management (HRM)**

Human Resource Management (HRM) is a strategic approach to managing an organization's most valuable asset: its people. It involves the systematic planning, development, and implementation of policies, practices, and programs that aim to attract, develop, motivate, and retain a skilled and diverse workforce. HRM encompasses various functions, including recruitment and selection, training and development, performance management, compensation and benefits, employee relations, and workplace health and safety. The overarching goal of HRM is to align the organization's human capital with its strategic objectives, fostering a positive work environment, maximizing employee performance and potential, and ultimately contributing to the overall success and sustainability of the organization.

Human Resources Development (HRD) is a multidimensional and multifaceted management process that cuts across all disciplines. It is the hub of organizational management. Healthfield (2008) defined HRD as "the frameworks for helping employees develop their personal and organizational skills, knowledge and abilities." (Ukwoma,2008)

HRM encompasses a wide range of activities aimed at effectively managing the people within an organization. It involves creating and implementing policies and procedures that govern employee behavior, ensuring legal compliance, and promoting fair and equitable treatment.

HRD improves current performance and provides suitable and qualified personnel to meet present and future needs. Moreover, a well-trained staff at whatever level will serve to enhance the quality of the organization's services. (Ukwoma,2008)

HRM also involves cultivating a positive organizational culture and fostering strong employee engagement and satisfaction. By nurturing employee development and

providing opportunities for growth, HRM plays a crucial role in enhancing individual and team performance. Additionally, HRM is responsible for managing employee relations, conflict resolution, and creating a safe and inclusive work environment. Overall, HRM serves as a strategic partner, working collaboratively with other departments to align human resources practices with organizational goals and drive long-term success.

### **Importance of Human Resource Management (HRM) in Library**

Human Resource Management (HRM) is of paramount importance in libraries due to the following reasons:

- 1. Talent Acquisition and Retention:** HRM plays a crucial role in attracting and hiring qualified professionals with the right skill sets and knowledge to meet the evolving needs of the library. Effective recruitment and retention strategies ensure that the library has a competent and motivated workforce to deliver quality services to its patrons.
- 2. Professional Development:** Libraries need to invest in the continuous professional development of their staff to keep them updated with the latest trends, technologies, and best practices in library and information science. HRM facilitates the identification of training needs, provides learning opportunities, and supports staff in acquiring new skills, thereby enhancing the overall expertise within the library.
- 3. Employee Engagement and Satisfaction:** HRM practices that prioritize employee engagement and satisfaction contribute to a positive work environment, fostering a sense of belonging, motivation, and commitment among library staff. Engaged employees are more likely to provide excellent customer service and actively contribute to the library's success.
- 4. Succession Planning:** HRM ensures that libraries have proper succession plans in place to address leadership vacancies and retain institutional knowledge. By identifying and nurturing potential leaders within the organization, HRM helps ensure smooth transitions and continuity in library management.
- 5. Performance Management:** HRM establishes effective performance evaluation systems that provide feedback, recognition, and opportunities for improvement. This process helps align individual performance with organizational goals and promotes a culture of accountability and excellence within the library.
- 6. Diversity and Inclusion:** HRM promotes diversity and inclusion in library staffing, recognizing that diverse perspectives and backgrounds enrich the library's services and foster innovation. HRM practices that value and respect diversity contribute to a more inclusive and equitable library environment for both staff and library users.
- 7. Employee Relations:** HRM plays a vital role in managing employee relations, addressing conflicts, and fostering a positive and harmonious work atmosphere. Effective communication channels and conflict resolution mechanisms help maintain a supportive and collaborative environment within the library.

HRM is crucial in libraries to attract, develop, and retain talented professionals, nurture a positive work culture, promote employee engagement and satisfaction, and ensure the library's long-term success in meeting the evolving needs of its users.

### **Nature of Human Resource Management (HRM) in Library**

People are the main drivers of organizations. To a large extent, they are the determinants of the success or failure of the organization. To remain committed and motivated, they must be managed in a transparent, consistent, and fair manner. To achieve this, organizations develop their human resource management practices to drive the management of its human resources. (Ikokoh,2021). The quality of any library service rest upon two foundations, the quality and commitment of the staff and the support and resources provided by the parent body. (Ikokoh,2021). The nature of Human Resource Management (HRM) in a library setting is characterized by its unique considerations and specific requirements. Here are some key aspects of the nature of HRM in a library:

1. **Academic Environment:** Libraries in academic institutions operate within an educational context, serving the faculty, students, and researchers. HRM in libraries needs to align with the academic mission and goals of the institution, supporting the educational and research endeavors of the community.
2. **Information Professionals:** Libraries employ information professionals who possess specialized skills and knowledge in library and information science. HRM in libraries recognizes the unique qualifications and competencies required for these roles, ensuring appropriate recruitment, training, and professional development opportunities.
3. **Continuous Learning:** Libraries are dynamic environments where new technologies, information resources, and research methodologies constantly emerge. HRM in libraries focuses on fostering a culture of continuous learning, providing staff with opportunities to enhance their skills and stay abreast of industry advancements.
4. **Customer Service Orientation:** Libraries are service-oriented organizations, with a primary focus on meeting the information needs of their users. HRM in libraries emphasizes the importance of customer service skills and a user-centered approach in hiring, training, and evaluating library staff.
5. **Collaboration and Teamwork:** Libraries often operate as collaborative spaces, with staff members working together to provide integrated services and support. HRM in libraries fosters teamwork, encourages effective communication, and builds a collaborative culture among library staff to enhance the user experience.
6. **Technological Integration:** HRM in libraries acknowledges the impact of technology on library services and operations. It focuses on recruiting and retaining staff who are technologically savvy and adaptable to new technologies. HRM also supports staff in acquiring digital literacy skills and keeping up with technological advancements relevant to library services.
7. **Ethical Considerations:** Libraries adhere to professional ethical codes, including principles of intellectual freedom, privacy, and equitable access to information. HRM in libraries ensures that staff members are familiar with these ethical considerations and incorporate them into their daily work.

- 8. Evolving Roles:** The roles and responsibilities of library staff have evolved over time, encompassing areas such as information literacy instruction, digital scholarship support, and data management. HRM in libraries adapts to these changing roles, redefining job descriptions, and providing training opportunities to equip staff with the necessary skills.

Overall the nature of HRM in libraries encompasses the academic environment, the unique roles of information professionals, the importance of continuous learning, customer service orientation, collaboration, technological integration, ethical considerations, and the evolving nature of library roles. HRM in libraries strives to align the library's workforce with the library's mission, user needs, and the changing landscape of library and information science.

### **Types of Human Resource in Library**

In a library setting, there are various types of human resources that contribute to the effective functioning and service delivery. The library HR officer is responsible for developing, implementing, coordinating, and monitoring all human resource programs and processes for academic librarians, professional, and classified staff, and hourly assistants. (Defa, Dannis 2008). The HR management team should attract the right talent to the public library, give appropriate compensation, retain them and also develop them to meet the current and future organizational goals. They need to keep track of the skills acquired by the employees during their tenure in the organization and deploy them for the right activities (Hafijull Mondal,2020)

Here are some common types of human resources found in libraries:

- 1. Librarians:** Librarians are professional information specialists who hold advanced degrees in library and information science. They play a central role in library operations, managing collections, providing reference services, conducting information literacy instruction, and overseeing library programs and initiatives. The Guidelines for Recruiting Academic Librarians have been developed to serve as an outline of the prototypical recruitment process. Within academic and research libraries, recruitment for a librarian position may follow different processes depending on the employment category used for librarians or other factors at that particular institution. Librarians may be hired as faculty (tenure-track or non-tenure-track) appointees, academic appointees, or as administrative or professional staff. (ACRL,2017)
- 2. Library Assistants/Clerks:** Library assistants or clerks provide support to librarians in various aspects of library operations. Their responsibilities may include shelving books, processing materials, assisting with circulation tasks, and providing basic customer services.
- 3. Technical Services Staff:** Technical services staff, such as catalogers or metadata specialists, are responsible for organizing and processing library materials. They ensure that items are accurately cataloged, classified, and made accessible to library users through the library's catalog or database.
- 4. Information Technology (IT) Specialists:** IT specialists in libraries handle the technical aspects of library systems and services. They manage computer networks, troubleshoot hardware and software issues, maintain library websites, and provide support for electronic resources and digital initiatives.

5. **Archivists:** In libraries with archival collections, archivists are responsible for preserving and providing access to historical and unique materials. They assess, arrange, and describe archival collections, manage digitization projects, and assist researchers in accessing archival materials.
6. **Instructional Designers:** Some academic libraries employ instructional designers who collaborate with faculty and librarians to develop and deliver effective information literacy and research instruction programs. They create instructional materials, design online learning modules, and provide pedagogical support to enhance teaching and learning in the library.
7. **Administrative Staff:** Administrative staff members handle the administrative and managerial aspects of library operations. They oversee budgeting, financial management, human resource functions, facility management, and other administrative tasks essential for the smooth functioning of the library.
8. **Subject Specialists/Liaison Librarians:** Subject specialists or liaison librarians have expertise in specific subject areas and work closely with faculty and students in those disciplines. They provide specialized research support, deliver discipline-specific instruction, and contribute to collection development in their assigned areas.

## Overview of HR Practices in Academic Libraries

These are some common types of human resources found in libraries, but the specific roles and positions may vary depending on the size, type, and focus of the library. HR practices in academic libraries involve strategies and policies for effectively managing the library's human resources. These practices include recruitment and selection, onboarding and orientation, professional development, performance management, compensation and benefits, employee relations, workforce diversity and inclusion, health and safety measures, and succession planning. By implementing these HR practices, academic libraries can attract and retain qualified staff, promote a positive work environment, support staff development, and align HR strategies with the library's mission and goals.

## Key Challenges in HR Practices

HR practices in any organization, including academic libraries, can face various challenges. Here are some key challenges commonly encountered in HR practices in academic libraries:

1. **Recruitment and Retention:** Academic libraries often face challenges in attracting and retaining qualified candidates, especially in highly competitive job markets. Limited budgets and salary constraints can make it difficult to offer competitive compensation packages. Retaining top talent may also be a challenge due to opportunities for career advancement outside of the library field.
2. **Workforce Diversity and Inclusion:** Ensuring diversity and inclusion in the library workforce can be a challenge. Libraries need to actively promote diversity in their recruitment and hiring practices and create inclusive environments that value and respect different perspectives, backgrounds, and experiences.



3. **Employee Development and Training:** Providing ongoing professional development and training opportunities for staff can be challenging, particularly in resource-constrained environments. Limited budgets, time constraints, and access to training programs or conferences can hinder staff development and the acquisition of new skills.
4. **Performance Evaluation and Feedback:** Developing effective performance evaluation systems and providing constructive feedback can be challenging. Objective measurement of performance, addressing varying job responsibilities, and providing meaningful feedback that promotes growth and improvement can present difficulties.
5. **Work-Life Balance and Staff Well-being:** Balancing workloads, addressing burnout, and promoting staff well-being can be challenging in libraries, where resources may be limited, and work demands can be high. Providing work-life balance initiatives and creating a supportive work environment are important but can be challenging to implement consistently.
6. **Technological Advancements:** Rapid changes in technology require continuous learning and adaptation by library staff. Keeping up with technological advancements and providing adequate training and support can be a challenge, particularly for libraries with limited resources or resistance to change.
7. **Changing Roles and Expectations:** The evolving nature of library services and user expectations can pose challenges in HR practices. Staff may need to develop new skills or adapt to changing job responsibilities, requiring ongoing training and support.
8. **Institutional Constraints:** Academic libraries operate within the framework of their parent institutions, which can impose constraints on HR practices. Budgetary limitations, bureaucratic processes, and institutional policies may impact the flexibility and effectiveness of HR practices.

Addressing these challenges requires proactive strategies, including innovative recruitment approaches, prioritizing diversity and inclusion, allocating resources for professional development, implementing effective performance management systems, promoting work-life balance, embracing technological advancements, and advocating for supportive institutional policies. Overcoming these challenges enhances the effectiveness of HR practices and contributes to the overall success of academic libraries in meeting their mission and serving their communities.

## Strategies for Overcoming HR Challenges

Like in other organizations there is a need for systematic development of human resources in libraries. However, there are issues and challenges in implementing these practices. (Ikoko, 2021) To overcome HR challenges in academic libraries, it is important to implement strategic approaches. Here are some strategies that can help in addressing these challenges:

### 1. Recruitment and Retention

- ☆ Develop attractive compensation packages within the constraints of the library's budget.

- ☆ Enhance the library's reputation as a desirable workplace through positive employer branding.
- ☆ Implement targeted recruitment strategies, such as networking with library associations and academic institutions.
- ☆ Offer professional development opportunities and career growth paths to retain talented staff.

## **2. Workforce Diversity and Inclusion**

- ☆ Develop diversity and inclusion policies and actively promote them in recruitment and hiring processes.
- ☆ Create a supportive and inclusive work environment that values diverse perspectives and experiences.
- ☆ Implement diversity training programs and initiatives to raise awareness and foster an inclusive culture.

## **3. Employee Development and Training**

- ☆ Identify staff training needs through regular assessments and performance evaluations.
- ☆ Explore online and cost-effective training options, including webinars, virtual conferences, and e-learning platforms.
- ☆ Foster a culture of continuous learning by encouraging staff to share knowledge and expertise.

## **4. Performance Evaluation and Feedback**

- ☆ Establish clear performance metrics and goals for each role within the library.
- ☆ Conduct regular performance evaluations that provide constructive feedback and support staff development.
- ☆ Implement a two-way feedback mechanism that encourages open communication between supervisors and employees.

## **5. Work-Life Balance and Staff Well-being**

- ☆ Promote work-life balance initiatives, such as flexible work schedules, remote work options, and wellness programs.
- ☆ Encourage staff to take breaks, vacations, and utilize support programs for mental and physical well-being.
- ☆ Foster a culture that values work-life balance and promotes a healthy work environment.

## **6. Technological Advancements**

- ☆ Provide staff with access to technology training and resources to enhance digital skills.
- ☆ Establish a technology committee or task force to monitor and implement technological advancements relevant to library services.

- ☆ Encourage staff to embrace technology and provide ongoing support through workshops and training sessions.

## 7. Changing Roles and Expectations

- ☆ Conduct regular job analyses to identify evolving job responsibilities and skill requirements.
- ☆ Develop targeted training programs to help staff acquire new skills and adapt to changing roles.
- ☆ Encourage a culture of continuous learning and innovation to foster staff adaptability.

## 8. Institutional Constraints

- ☆ Advocate for increased resources and support from institutional leaders and decision-makers.
- ☆ Collaborate with other departments and libraries to share resources and knowledge.
- ☆ Seek opportunities to influence institutional policies to better align with the library's HR needs.

By implementing these strategies, academic libraries can address HR challenges, foster a positive and inclusive work environment, attract and retain talented staff, and ensure the library's continued success in serving its academic community.

## Conclusion

In conclusion, overcoming HR challenges in academic libraries requires proactive and strategic approaches. By implementing strategies such as enhancing recruitment and retention practices, promoting diversity and inclusion, prioritizing employee development and training, implementing effective performance evaluation systems, supporting work-life balance and staff well-being, embracing technological advancements, and navigating institutional constraints, academic libraries can create a positive and thriving work environment. These efforts contribute to attracting and retaining talented staff, fostering innovation and growth, and ultimately serving the library's mission and the needs of its academic community.

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