Colleges: Untapped avenues

Concerns regarding the exodus of faculty or poor quality induction in the academic system are often raised in *Current Science*. The reasons for this plight are lack of job opportunities, poor salary and infrastructure, promotion policy, bureaucratic hurdles, internal bickering among fellow colleagues, etc. Solutions, both by governmental committees and discussions in journals and seminars, have been proposed. Yet the overall situation remains the same. If the situation is assessed neutrally, our national laboratories and some university departments are well equipped. Though not equipped with the state-of-the-art instruments available in foreign laboratories and academic institutions, at least they are the second best in many establishments. Procurement or installation delay or non-functioning of instruments is a different matter as this depends upon the managerial quality of the person heading the organization.

As far as job opportunities are concerned, national laboratories and university departments have limited and infrequent job openings and these are generally filled by in-house candidates waiting for these jobs. Out of nearly four lakh faculty, around 15% is employed in universities and the rest work in colleges.

The research performance of college faculty is certainly far below compared with their university counterparts. This is attributed to lack of freedom and a non-conducive academic environment in the college campuses, whimsical behaviour of authorities, preferential treatment to university departments in terms of grant release by the University Grants Commission or other funding agencies, promotion policy, poor laboratory and library facilities, lack of quality students intake, apathy to research by government/management and principals or to development in general, psychological complex among teachers, engagement of faculty in non-academic activities and location in remote areas. Yet in terms of salary and allowances, they are at par with university faculty till they get Reader's grade. Currently, college teachers end their career with Reader/Assistant Professor designation in the Government and Government-aided colleges. After a time-bound Reader's tenure university faculty move to Professor level after 18 years of service based on their research and administrative records. Only isolated cases are available where screening committees deny promotions to teachers. Pay Commissions in the past have also recommended selective Professors' posts in colleges but the Governments have not implemented this for various reasons.

The presently practised outright discrimination of college teachers is enough to dissuade them from doing research. It is not true that all college faculty lack the research aptitude. Many teachers are committed to their work and are contributing well to research. Yet, as a whole, colleges carry a negative image in academic and Government circles for the above-mentioned reasons. As a first step to solve these problems, colleges should be treated at par in terms of promotion, i.e. induction of Professor grade so that best talent should aspires for college jobs. In colleges, initially Professorship can be given on selective basis of performance and screening. Once this avenue with riders is announced, there may be a demand for automatic promotion to all teachers from the teachers' associations. This can be tackled with administrative will. To begin with, a state-level or national-level body may be constituted to implement the scheme. Even if 20% teachers are promoted to Professors post by open interview after implementing transparent assessment procedure, this will suffice to change the academic canvas. Research would get a quantum jump and the emerging competition from college faculty would, in turn, compel the university faculty to upgrade their research performance. Since economy is leaning more towards knowledge and the country is facing shortage of quality output, colleges cannot be ignored anymore. Modest increase in financial burden will improve the quality substantially. Once committed persons become part of the college set-up, they will upgrade the facilities by obtaining research grants. The case of unaided private institution does not fit into this scheme of things.

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Anticrop bioterrorism

The 9/11 happenings have changed the world around us. They have forced us to consider terrorism as a real threat. Bioterrorism is a form of terrorism where a biological agent can be used to unleash terror. All it needs is a perverted mind and the biological agent may be fungi, bacteria or viruses. Here we will deal with agricultural bioterrorism or anticrop bioterrorism. In this form of terrorism pathogens of important crops, biocontrol agents and microbes involved in nutrient recycling can be used. Iraq had an active bioweapons programme before the Gulf War, part of which dealt with wheat smut, and the likely target was Iran.

Let us also mention a few terminologies which are closely related with this issue. Although the terms bioterrorism and biosecurity can be used interchangeably, it is not so in the case of biosafety. Biosafety measures are actually meant to prevent accidental release of pathogens from research facilities, whereas biosecurity measures are intended to prevent the deliberate use of deadly microbes. In case of pest risk analysis or import risk analysis, we actually deal with the process of evaluating biological or other scientific and economic evidence to determine whether the pest associated with the commodity should be regulated or not.

Advancement in recombinant DNA technology can actually be a real threat in this perspective. Since desirable genes can be transferred from one organism to

another, greed for money and lack of ethics can make anything available in this world no matter how secure it may be.

Now the question arises as to which pathogens can actually be utilized by terrorists. If we look back, several plant pathogens have created famines, e.g. late blight of potato (1845) in Ireland which reduced the population from 8 million to 4 million; coffee rust in Sri Lanka (1867), due to which the country lost crores of rupees in coffee export, reducing it by 93%. These instances were natural, but we cannot deny their potential as man-made threats in modern times. Pathogens that have high multiplication rates and variability can cause great destruction, e.g. pathogens of wheat rust, Karnal bunt and rice blast. These staple crops can also be targetted because of their high acreage in certain countries. Even wilt pathogens like *Fusarium* and *Ralstonia* can establish easily, but are hard to eliminate. Continuous cropping of the same crop in same field for socio-economic reasons further aggravates the situation, because these pathogens have a good opportunity for multiplication and survival. Some pathogens have the ability not only to reduce yield but also produce mycotoxins which have fatal or chronic effect on humans and animals, e.g. ergot of pearl millet (*Claviceps purpurea*). Hyperparasites of biocontrol agents can damage the natural equilibrium and cause upsurge of pathogens, resulting in heavy yield losses.

This scenario can only happen in a country where the potential candidate is not present naturally. However, for the candidate pathogens which are already present, some perverted minds can try to convert some pathogenic fitness attributes to their advantage through biotechnological tools like changing latent period, sporulation capacity, lesion size and ability to produce toxins. Some viruses might be genetically engineered to make plants more vulnerable to other already prevalent diseases and to break the resistance genes for major diseases.

Important possibilities are as follows:

1. Pathogen genome is changed in such a way that its environmental requirements are bare minimum.

2. Converting a plant pathogen, which can also infect livestock and humans (a wild thought of course, but definitely a possibility in this biotechnologically advanced era).

3. Changing sites or processes in pathogens, which are targetted by fungicides, thus rendering them ineffective.

4. Incorporating genes in a pathogen, which can help in degrading fungicides.

5. Converting an airborne pathogen to a seed-borne one.

6. Converting a pathogen into a form which can cause maximum damage to floral parts.

7. Pathogens which are capable of producing hundred times more deadly toxins that are also less heat liable (become more toxic when processed).

8. Pathogens created to attack nitrogen-fixing and phosphate solubilizing and other microbes which help in the recycling of nutrients.

9. Pathogens which can selectively damage the most economical component of a crop, like aroma in basmati and essential oils in medicinal and aromatic plants.

10. Increasing survival ability and saprophytic nature of the pathogens.

Preparedness alone can act as a potential deterrent, hence we list below steps to be taken to face the threat of bioterrorism.

1. Framing of stringent rules regarding transfer of deadly plant pathogens for peaceful purposes, and the persons involved should be made more accountable.

2. Coordinated research regarding averting the consequences, which can arise after anticrop attack.

3. Developing robust biocontrol agents.

4. Proper listing of pathogens which are not present in a country, but if introduced can cause havoc due to prevailing environmental conditions and cropping pattern (pest risk analysis).

5. Effective monitoring to identify and check the spread. For this, handy and rapid identification tools must be developed.

6. Disaster management plan should be formulated at least in case of major crops.

7. Satellite surveillance can help tremendously since infection can be detected before symptoms appear, giving us ample time to formulate management strategies.

8. Simulation experiments for predicting future races in case of major pathogens.

9. Incorporation of horizontal resistance should be made mandatory.

It is clear from the above discussion that the problems are not insurmountable and can be prevented or managed with proper planning and implementation. Many countries are taking it as a real threat and have enacted laws to deal with this threat. International organizations like WHO, FAO and research organizations should work in tandem to formulate prevention and combat strategies. Strong political and administrative will is required to avert the imminent danger.

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