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MICROBIAL HERBICIDES

Tailoring research for market

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Were it not for the role of the world agrochemicals majors like Du Pont, Aventis and Monsanto in promotion of use of herbicides in India, their segment would not have witnessed the rapid growth in the late nineties. They demonstrated that judicious application of herbicides always shifted the cost-benefit ratio in favour of the farmers. Globally, herbicides account for about 45 per cent of world pesticide usage and there is an increasing concern about the environmental pollution due to their indiscriminate use. Consider, for instance, the presence of pesticides in ground and surface water and thence in potable waters is leading water companies to spend millions of dollars on removing pesticides from water supplies. Thus, the development of alternative weed control strategies has become a mandate. These range from revival of old technologies such as mechanical weed control strengthened by combination with the use of low doses of herbicides to modern biotechnological approaches such as conferring herbicide resistance to crop plants by recombinant DNA and other technologies.

Within the range of options being developed for farmers and growers, biological control has received sustained attention for more than 20 years. Research in this subject has expanded rapidly in scope from simple collection, isolation and screening of plant pathogenic microorganisms to include studies of formulation of viable products, ecology and epidemiology of released organisms, plant-pathogen interactions at the organismic, biochemical and genetic levels and of genetic manipulation of candidate microbial herbicides.

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Research into microbial herbicides commenced in the late 1960s in the USA with investigation into pathogens for the control of strangle vine (*Morrenia odorate*) in citrus groves in Florida. Of microbial herbicides, only one chemical compound out of 10, 000-15,000 screened becomes a saleable pesticide product.

Research into microbial herbicides commenced in the late 1960s in the USA with investigation into pathogens for the control of strangle vine (*Morrenia odorate*) in citrus groves in Florida. The geographical spread of interest was demonstrated when Samarkand Alisher University obtained a patent in 1971 for the control of broomrape (*Orobanche* sp.) in [illegible]. In the early 1980s, two products namely Devine and Collego prepared from *Phytophthora palmivora* and *Colletotrichum gloeosporioides* f.sp. *aeschynomene* respectively, were registered with Environmental Protection Agency (EPA) and commercially made available to the farmers. This stimulated the rapid expansion of research in this area resulting in the discovery of many potential microbial herbicides. [illegible] of the [illegible] agents listed except *Chondrostereum purpureum* and *Cercospora rodmanii*, rest are in use, either as commercial products or via subsidized production within the public sector. Certainly the position of microbial herbicides is more favourable than of the agrochemical industry where, commonly only one chemical compound out of 10,000-15,000 screened becomes a saleable pesticide product. However, the success rate of microbial herbicides might not be as good as it appears. The commercial prospects of these agents were based on host-specificity, efficacy, regulatory aspects and technological feasibility. These parameters are capable of identifying agents as potential commercial products. Before the product success can be defined properly, considerable stress must be given to the economics of production and use.

The economics of production should not pose unsolvable problems. The wide range of options available

Table I: Microbial Herbicides in Commercial/Practical Use

	Target Weed	Pathogen	Product Name
1)	Northern jointvetch	*Colletotrichum gloeosporioides f.sp. aeschynomene*	Collego
2)	Sicklepod	*Alternaria cassiae*	CASST
3)	Kosters curse	*C.gloeosporioides f.sp.clidemiae*	—
4)	Dodders	*C.gloeosporioides f.sp. cuscutae*	LUBOA 2
5)	Persimmon	*Cephalosporium diospyri*	—
6)	Water Hyacinth	*Cercospora rodmanii*	—
7)	Hydrilla	*Fusarium roseum 'culmorum'*	—
8)	Round leaved Mallow	*Colletotrichum gloeosporioides f.sp. malvae*	BIOMAL
9)	Stranglervine	*Phytophthora palmivora*	DEVINE
10)	Broom rape	*Fusarium oxysporum var. Orthoceras*	—
11)	Black cherry	*Chondrostereum purpureum*	—

Source : Microbial Control of Weeds

dual opinion regarding microbial herbicides--they have afocal interest only in broad-spectrum activity and regard the high specificity of microbial herbicides as a disadvantage. On the other hand, they see the potential advantage in a microbial herbicide if it controls an important weed target that in not controlled by chemical products, particularly if compatibility and timing permit mixing with a broad-spectrum chemical herbicide. In recent years, the industry has started showing interest in niche markets where saleable product values may be higher or environmental constraints on chemicals greater. Such markets may sustain products specifically designed to control single weed species or at least, a narrow spectra of weeds.

The weeds mentioned in table 1, can cause significant economic crop losses in the regions, where they are a problem, but the areas affected are too small to be commercially viable in economic terms. The products, 'Collego' and 'Devine' are generally not considered to be profitable but they do exist in the product line of a company because they advertise the organization's commitment to the customers and the environment. It is a matter of keen interest to see whether 'Biomal' (first available as a product in 1992-93) will sustain in the market or not.

According to industrial forecast, biopesticides will form about 20 per cent of the crop protection market by the year 2025 and microbial herbicides will contribute only to niche markets. With appropriate research effort, they will gain a significant foothold in the paradigm of plant protection. The pivotal points of success are proper selection of the weed, reliable performance of the herbicide and its stability at the field level. Knowledge of formulation chemistry, strain selection and development, pathogen genetics, ecology and epidemiology has advanced greatly in the last decade and gives the confidence that technological answers to most, if not all the constraints on microbial herbicide efficacy and reliability, can be found.

This hope is evident in the abiding interest with which the scientists programmed on microbial herbicides champion their cause. In the coming years, the alternate strategies of weed control must be channelled into more commercially attractive projects and ,above all, supported by appropriate financial and personnel resources from the public and private sectors, to give the world of plant protection a new meaning. ■

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