Significance of Biotechnology in Agriculture: A Review Article

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ABSTRACT: In agriculture and forestry, the application of biotechnological advances has increased over the past two decades. Numerous advantages of biotechnologies are documented; however, implementation is problematic and technological, biophysical and societal challenges continue to be faced. The longer history of biotechnology in agriculture holds potential lessons for emerging forestry ideas, and vice versa. Using a systematic study and content analysis of agricultural and forestry scholarly literature (235 articles) between 1989 and 2020. In terms of justifications for the use of biotechnologies, obstacles to and implementation guidelines, and types of evidence considered, we compare these two fields. Food protection is the primary advantage of biotechnologies found in the agricultural literature, while forest production and climate change adaptation are the most common motivating justifications in the forest context. In the literature on forestry, we find a comparatively greater focus on regulatory and legal obstacles. Despite comparatively less focus on these items as defined obstacles, both fields stress recommendations to overcome barriers related to lack of awareness and governance processes. As compared to 51 percent of those in agriculture, relatively few (32 percent) forestry articles were informed by perspectives from social sciences and humanities.

KEYWORDS: Agriculture, Agricultural, Biotechnologies, Forestry, Literature.

INTRODUCTION

The application of revolutionary biotechnologies in the agricultural and forestry sectors has increased over the past two decades. However, compared to agriculture, the forestry industry is in a relatively early stage of biotechnology adoption. Forest trees are mostly undomesticated, long-lived, and slow to achieve reproductive maturity, unlike agricultural crops. These features make them difficult genetic subjects that, in part, account for a lag in genetic knowledge of trees relative to crops[1].

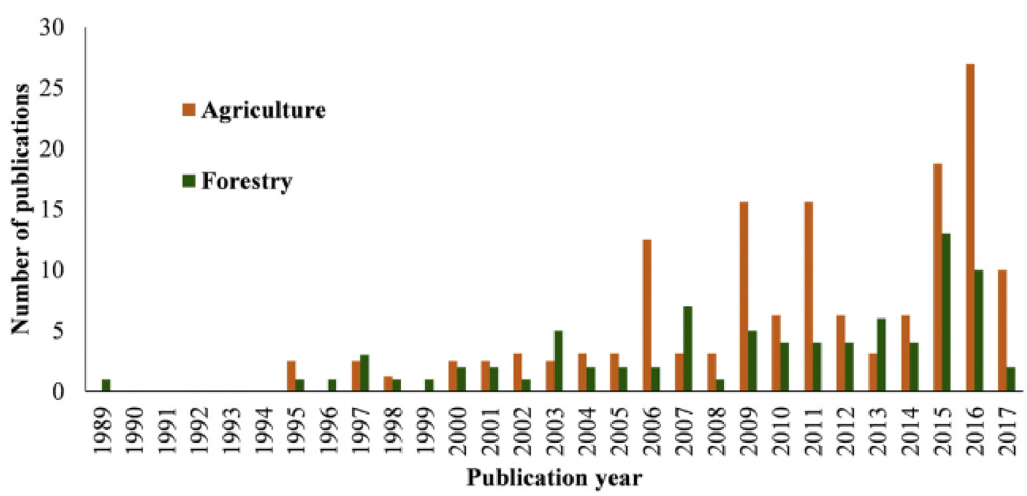

Figure 1: Illustrates the year of publication[2].

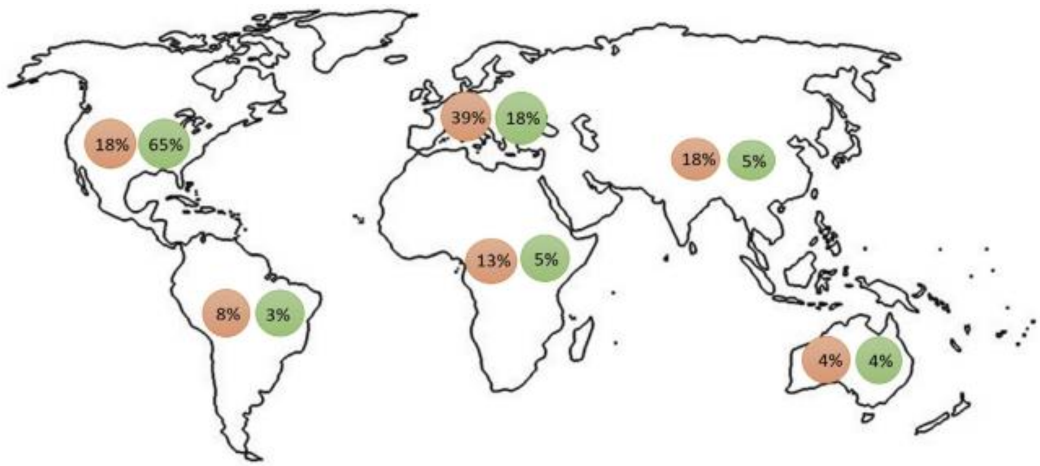

Figure 2: Illustrates the geographic focus[3].

Nevertheless, momentum is gathering towards increasing the use of biotechnology in forestry. In particular, biotechnological modifications are progressively being considered to enhance forest health in order to make trees insect-resistant (National Academies of Sciences, Engineering and Medicine, 2019) and to increase resistance to climate change impacts, such as severe drought events and forest fires. Biotechnology also has the ability to improve the productivity of timber production[4].

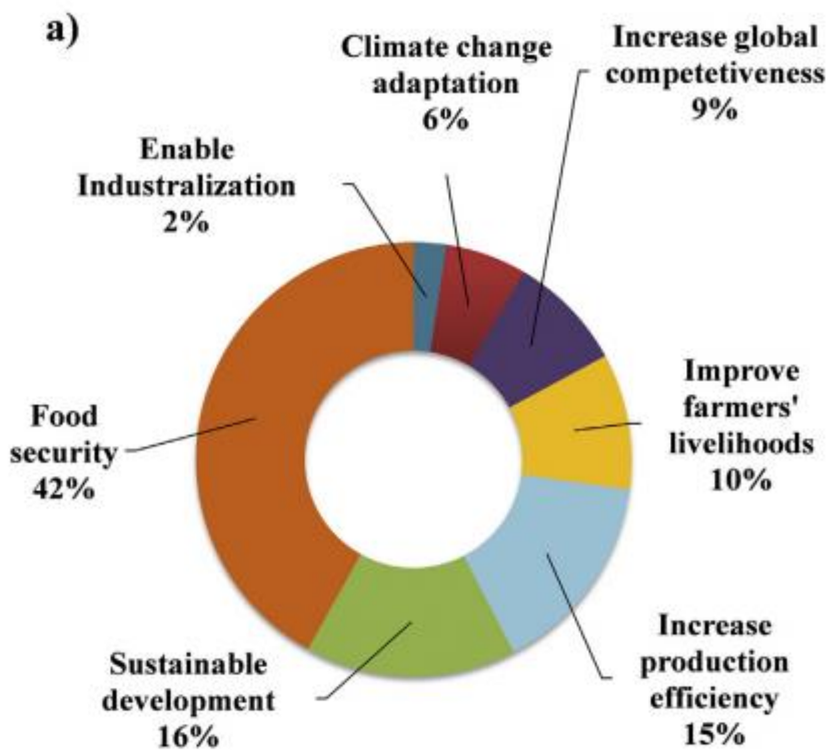

Figure 3: Depicts the agriculture[5].

DISCUSSION

Over the past two decades, there has been a growing recognition among policymakers, researchers and industry that efforts should be made to engage stakeholders and the general public in constructive dialogue at the earliest possible stage of implementation and before decisions are taken (i.e. an 'upstream approach') about emerging and potentially controversial technological interventions. Our findings indicate that some elements of an upstream approach to tree biotechnology are overwhelmingly recommended in the scientific literature, illustrated by the many guidelines on integrating public feedback and improving transparency, among others[3].

The fact that public education is the most common suggestion cited to counter public opposition, however, is troubling. For example, there is empirical evidence indicating that knowledge of biotechnology has little to no impact on public acceptance of biotechnology and that, in response to new information, risk perceptions, particularly for genetically modified trees, are not easily altered. Yet, calls for public education have risen over time in our survey. An effort to simply 'educate' numerous audiences to fill an actual (or perceived) awareness void within an upstream strategy merely provides a one-dimensional way of understanding social issues at best, and a tokenistic response at worst to formidable (and potentially violent) public opposition. Compared with agricultural biotechnology[6][7], we highlight many research disparities, including regional and methodological ones in tree biotechnology. The need to further explore the consequences for intellectual property and tenure, and cultural threats in the forest sector, as well as to understand how tree biotechnology is framed outside scientific literature, also involves further research gaps.

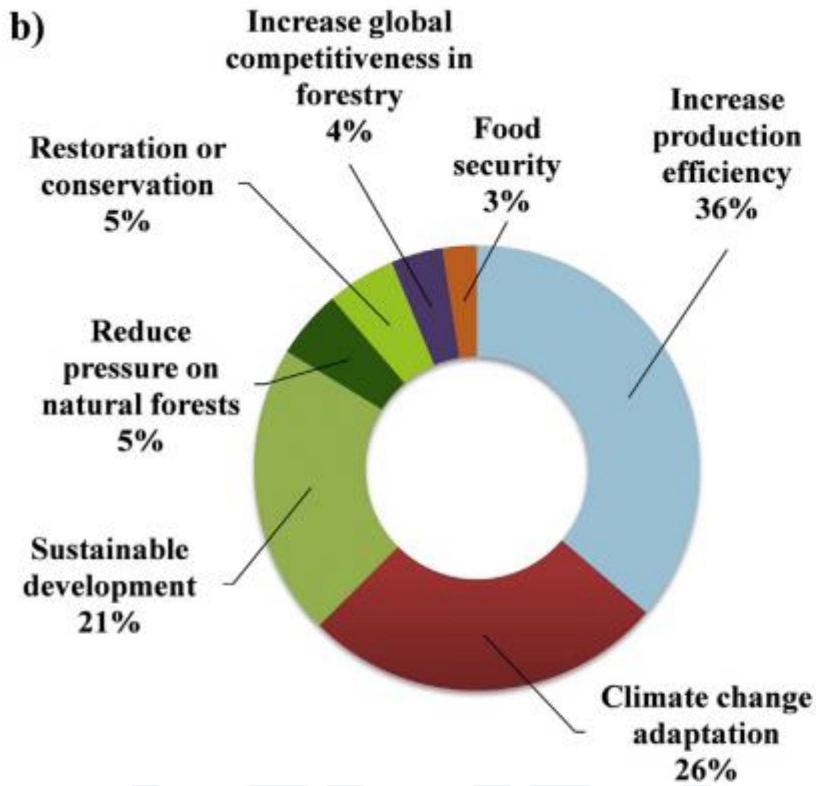

Figure 4: Depicts the forestry[8]**.**

Figure 1 illustrates the year of publication. Figure 2 depicts the forestry. Figure 3 depicts the agriculture. Figure 4 depicts the forestry.

CONCLUSION

This research uses a comparative systematic analysis to draw parallels and observations by taking advantage of the longer and well-documented history of agricultural biotechnology to predict potentially shared (and also unique) challenges and guidelines for biotechnology adoption as they are more widely pursued in forestry. We do not concentrate on the particular political mechanisms that essentially restrict the introduction in specific jurisdictions of biotechnology applications. Rather, we present a comparative study that offers a systematically derived synthesis of obstacles to and recommendations for the adoption of biotechnologies in agriculture and forestry by applying analytical instruments from the social sciences to an interdisciplinary task. Our analysis provides an overview of the peer-reviewed biotechnology scientific literature for a specific period and within the framework of our sample framework and methodology. The search for the database was limited to capturing articles in their titles, abstracts, and keywords mentioning search terms. As such, it may not have captured any related papers. By checking several different search strings, testing the training sets for relevance, and selecting the most inclusive and wide-ranging search words, we tried to minimise this. Although incomplete, our systematic approach's broad sample size and consistent reporting provide a degree of confidence that this is a legitimate and meaningful analysis.

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