

**AGENT-BASED SIMULATION OF BIOLOGICAL NITROGEN FIXATION:
FROM PASSIVE OBJECTS TO ACTIVE ENTITIES**

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This paper discusses the prospects and advantages of using the agent-based individual-oriented approach to the modeling of production processes in agro-ecosystems as an example to describe the process of symbiotic nitrogen fixation. It was found that the transition to complex system representation as an assembly of active agents with purposeful behavior allows not only to simulate system dynamics in the cause-effect approach, but also to explain the observed regularities in nature and phenomena in terms of their evolutionary origin. Mathematical apparatus of the theory of optimization and optimal control are used along with the classical methods of system dynamics for construction and identifying the corresponding hybrid models.

Keywords: agent-based models, biological nitrogen fixation, rhizobia, nodules, system dynamics.