

Socio-productive profile of family farms and their connection to rural technical assistance and extension in Realeza-PR

Caracterização socioprodutiva de estabelecimentos familiares e sua relação com a ATER no município de Realeza-PR

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Abstract: Agricultural extension in Brazil has undergone significant methodological changes since its institutionalization in 1948. This study analyzes these transformations by examining 21 family farms assisted by the Institute of Rural Development of Paraná (IDR-Paraná). Data were collected through a semi-structured questionnaire to identify family profiles, producer–extensionist relationships, and the adoption of production techniques. The results indicate that assisted producers present a distinct economic profile: while the agricultural census shows that only 26.78% of local farms earn more than BRL 100,000 annually, more than 50% of the farms in the analyzed group exceeded this threshold, despite similar conditions in land availability, education level, and herd size. Statistical analysis suggests that the technician–producer relationship plays a central role in technological adoption. Producers with adequate knowledge of extension services are 2.273 times more likely to adopt favorable practices, while those with a positive attitude toward technical assistance have a 2.26 times higher probability of implementing such practices. The findings also reveal a high level of technological consistency among assisted farmers, contributing to the greater adoption of techniques aligned with production standards and existing producer knowledge.

Keywords: rural development, technical advice, rural policy.

Resumo: No Brasil, desde seu início, em 1948, a assistência técnica passou por mudanças nas metodologias adotadas pelos extensionistas. Este estudo analisou 21 propriedades rurais da agricultura familiar assistidas pelo programa de extensão rural do Instituto de Desenvolvimento Rural do Paraná, com o objetivo de conhecer o perfil das famílias, a relação dos produtores com a extensão rural e a adoção de técnicas produtivas nessas propriedades. Como instrumento metodológico, utilizou-se um questionário semiestruturado com perguntas direcionadas a pelo menos um integrante da família. Os assistidos possuem perfil econômico distinto dos demais produtores familiares do município, já que o censo agropecuário aponta que 26,78% das propriedades apresentam renda anual superior a 100 mil reais, em sentido contrário ao observado neste estudo em que o percentual ficou acima de 50%. Mesmo assim, apresentam semelhanças na disponibilidade de área, escolaridade e número médio de vacas em lactação. Ao analisar a relação entre técnicos e produtores, foi possível verificar que aqueles que possuem conhecimento adequado sobre a extensão rural e atitudes favoráveis à extensão, acabam adotando mais práticas produtivas. Observou-se que produtores com conhecimento adequado têm 2,273 vezes mais chances de adotar práticas favoráveis à produção. Ao mesmo tempo, para aqueles que possuem atitude favorável ao trabalho técnico, a chance de empregar práticas adequadas é 2,26 vezes maior. Ainda, existe semelhança na utilização de tecnologias de produção pelos assistidos no município de estudo, resultando em maior realização de técnicas que corroboram as normativas de produção, ou que estão ligadas ao conhecimento prévio dos produtores.

Palavras-chave: desenvolvimento rural, assistência técnica, política rural.



1 Introduction

Rural extension in Brazil began in the mid-twentieth century and, since then, three major approaches to the relationship between extension agents and rural producers have stood out in the literature: the *humanist-assistance* model, the *diffusionist-productivist* model, and the *critical humanist* model (Amaral Junior, 2020).

The early phase of rural extension, around 1948, was marked by a humanist-assistance approach, in which the technician acted as an instrument of “modernization” for the rural population. Beginning in the 1960s, the diffusionist-productivist model was adopted. This approach emphasized technology transfer and was based on the “learning by doing” method. Imported from the United States, this model has been widely criticized for its inability to educate rural populations with limited formal schooling, ultimately benefiting only a segment of those receiving assistance (Lisita, 2005).

In response to criticisms of the diffusionist-productivist model, scholars began advocating for what became known as the critical humanist approach, which introduced a new understanding of the role of rural families and emphasized participation and the appreciation of local knowledge by extension agents (Rodrigues, 1997). After years of transformation in Brazil’s agricultural landscape—particularly with the growing divergence between family farming and agribusiness—Federal Law No. 12,188 was enacted in 2010, establishing new parameters for the implementation of public policies aimed at supporting rural properties, especially those engaged in family farming.

The National Policy for Technical Assistance and Rural Extension for Family Farming and Agrarian Reform (PNATER) (Law No. 12,188, Brasil, 2010) was instituted to promote sustainable rural development, foster gender equity, and strengthen national food sovereignty. According to Diesel et al. (2015), the federal government reestablished its role in the provision of extension services through PNATER, both by allocating federal budget resources and by creating regulatory frameworks to reorient the work of extension agents. To operationalize this policy, the National Program for Technical Assistance and Rural Extension in Family Farming and Agrarian Reform (PRONATER) was created, becoming responsible for implementing and executing extension services.

The state of Paraná is one of Brazil’s leading milk producers, with production concentrated predominantly in family farming; 86% of dairy farms produce fewer than 250 liters of milk per day. The Southwest region of the state accounts for the highest milk output, with family farming as the primary source of dairy production (Alves et al., 2020). The Rural Development Institute of Paraná (IDR-PR) is the governmental body responsible for implementing technical assistance and rural extension policies. Its mission includes promoting farmer training, facilitating access to public policies and credit programs, and fostering rural development throughout the state (Law No. 20,121, Paraná, 2019).

In the municipality of Realeza, family farming plays a central economic role, with dairy cattle production constituting the primary source of household income. The municipality produces over 15 million liters of milk annually, of which slightly more than 13 million liters originate from family farming (Instituto Brasileiro de Geografia e Estatística, 2017). Therefore, evaluating the regional context is essential, as most studies on Brazilian rural extension rely primarily on census data and often lack sufficient resources to account for the diverse realities experienced by rural producers (Domingues & Rover, 2026).

Considering that dairy farming represents a key activity within family agriculture and requires technical assistance for its development, this study aimed to characterize the profile of dairy

farmers assisted by IDR-PR in the municipality of Realeza (PR), examine their relationship with the state rural extension program, and describe the characteristics of the assisted rural properties.

2 Theoretical Foundation

Family farming represents an alternative rural development strategy to the agribusiness model. Family members perform nearly all production-related tasks, from raw material acquisition to processing, product development, and market access. Nevertheless, access to new knowledge, innovations, and technologies remains essential (Schneider & Cassol, 2013).

Family-based agricultural activity plays an important role in directly and indirectly generating employment and income, thereby supporting families' continued presence in rural areas. However, when producing food of animal origin, these units must comply with legal requirements for regulation and commercialization, often encountering difficulties in this process and facing significant production risks (Guanziroli et al., 2012).

Such challenges can be mitigated through the presence and action of institutions responsible for designing and implementing rural extension initiatives, particularly for low- and medium-scale farms lacking alternative sources of technical information. Despite the adoption of PNATER and the creation of the National Agency for Technical Assistance and Rural Extension (ANATER), data from the 2017 Agricultural Census indicated that a substantial proportion (79.8%) of producers did not perceive themselves as being assisted by a rural extension program (Peixoto, 2020). Social indicators suggest that persistent inequalities remain a major challenge, with rural producers among those most affected by the limited incorporation of this population into regional development strategies (Pereira & Bazotti, 2010).

Inequality in rural areas may be further exacerbated by public and private technical assistance systems which, by promoting the adoption of high-impact production technologies, tend to benefit those with greater access to credit or higher levels of capital for investment. This underscores the fragility of rural extension services for family farming, whether due to the mere transfer of production technologies without an adequate educational process or to limited access to rural credit among family farmers (Braga et al., 2019).

Rural extension is inherently an educational process. However, for many years, technologies were simply made available to producers without implementing a model capable of integrating technical knowledge with the experiential knowledge developed by farming families within their specific contexts. For this reason, rural extension holds the potential to be emancipatory when grounded in participatory methodologies that enable knowledge exchange between technicians and producers (Schönardie, 2019).

The transition from a diffusionist extension model to a participatory approach between producer and technician is a natural development as PNATER expands and is implemented nationwide. This transition requires increased investment in expanding service provision and training extension agents (Faria & Duenhas, 2019). Thus, PNATER 2003 was designed to serve family farming in an accessible manner and to promote rural development across diverse contexts (Dias, 2007), with extension activities responding to demands while respecting the knowledge, practices, and cultures of the actors involved (Caporal & Costabeber, 2004).

Furthermore, this transformation depends on improving the training of future extension professionals. Academic and technical education must provide exposure to rural environments and their diverse realities. Training in agricultural sciences should therefore equip professionals with strong technical foundations while fostering the social competencies necessary to adapt to different rural contexts (Dias, 2008; Melotti et al., 2020; Facco et al., 2022).

3 Methodology

This study was conducted following approval by the Research Ethics Committee (REC), under protocol number 6,061,377. Subsequently, open-access data from IDR-PR were collected, and a semi-structured questionnaire was administered to 21 family farming properties in Realeza (PR) assisted by the agency's rural extension program. Participation was voluntary and followed the signing of an Informed Consent Form (ICF).

Inclusion criteria were based on the Family Farming Law (Brasil, 2006): properties with up to 80 hectares (four fiscal modules), predominantly family labor, income derived from the rural establishment, and family-based management. Only respondents who met these criteria and consented to participate were included in the analysis.

Methodological limitations were encountered but mitigated through support from both the local community and academic collaborators. Due to limited funding, field visits were conducted using the researchers' own resources, with logistical support from IDR-PR and the municipal government. Consequently, the study was geographically limited to the municipality of Realeza. Participant selection followed consultation with IDR-PR technicians, who identified producers under continuous technical follow-up and still engaged in dairy production.

A cross-sectional, observational study design was employed. The semi-structured questionnaire included items addressing the socioeconomic profile of the property, as well as knowledge, attitudes, and practices (KAP) regarding extension work and the productive characteristics of assisted farms.

Questions were developed based on the IDR-PR "Marco Zero" document, used by extension agents for farm registration, production diagnostics, and monitoring evaluation. Information collected included education level, age, years of experience in rural work, average monthly gross income, duration of technical follow-up, and production technologies adopted, including whether these technologies were recommended by IDR-PR.

Adequate knowledge was defined as awareness of PNATER and understanding of its objectives and the importance of technical assistance. Adequate attitudes referred to believing that the extension program contributes to farm development and recognizing that large landholdings or greater financial resources are not prerequisites for benefiting from extension recommendations. Adequate practices were defined as maintaining effective dialogue with the extension agent and receiving IDR-PR technical guidance for more than half of the production technologies used on the farm.

To measure adequate practices, 43 production technologies described in the IDR-PR "Marco Zero" were considered. Five technologies related to milking and herd management were analyzed for productive characterization. The KAP method (Knowledge, Attitudes, and Practices) (Paiva et al., 2010), adapted for this study, was employed. This method assesses respondents' knowledge of the topic, their attitudes toward it, and the practices implemented based on their understanding and perceptions (Kaliyaperumal, 2004).

Data were tabulated and analyzed using Excel 2011, Jamovi, and Epi-Info™. Descriptive statistics included absolute and relative frequencies, means, and standard deviations. Prevalence ratios were calculated to assess associations between Knowledge, Attitudes, and Practices, and the Mann-Whitney U test was used to determine statistical significance.

4 Results and Discussion

Productive data and the social profile of assisted families in the studied municipality indicated that producers ranged from 18 to 60 years of age, with most having more than 15

years of experience in rural activities. Among respondents, 85.72% had completed primary or secondary education, with the largest proportion having completed primary education (47.62%) (Table 1).

According to Cruz et al. (2021), increases in years of schooling among individuals classified as family farmers were associated with greater access to PRONAF and to technical assistance and rural extension services, highlighting the importance of education for accessing information and technology in rural contexts.

Table 1 – Socioeconomic profile and years of experience in rural activities among producers assisted by IDR-PR in the municipality of Realeza (PR), 2023.

Variables	Frequency
Producers' Age	
18 to 30 years	19.05% (4/21)
31 to 40 years	19.05% (4/21)
41 to 50 years	28.57% (6/21)
51 to 60 years	33.33% (7/21)
Producers' Educational Attainment	
Incomplete primary education	4.76% (1/21)
Completed primary education	47.62% (10/21)
Incomplete secondary education	4.76% (1/21)
Completed secondary education	38.10% (8/21)
Incomplete higher education	0.0% (0/21)
Completed higher education	4.76% (1/21)
Years of Experience in Rural Activities	
Up to 5 years	4.76% (1/21)
6 to 10 years	4.76% (1/21)
11 to 15 years	0.0% (0/21)
More than 15 years	90.48% (19/21)

Source: The authors (2023).

The farm size distribution was relatively homogeneous, with no marked disparities in land concentration among the properties. In contrast, monthly gross income showed greater variability: 47.62% of the farms reported a monthly gross income exceeding BRL 15,000 and maintained, on average, approximately 20 lactating cows per property (Table 2).

Differences were observed between the overall profile of family farmers in the municipality of Realeza (PR) and the families receiving technical assistance from the state of Paraná (Instituto Brasileiro de Geografia e Estatística, 2017). The divergence in farm profiles may be associated with the length of follow-up provided by IDR-PR, but it may also indicate the continued presence of extension services among higher-producing farms. Government-provided rural extension services are particularly important for producers facing financial constraints. According to Pereira & Castro (2022), the primary source of technical assistance and rural extension for family farmers is the State. Nevertheless, further research is needed to assess the quality of services delivered, especially considering the number of producers per technician, duration of follow-up, and the satisfaction of assisted families (Domingues & Rover, 2026).

Table 2 – Farm size, household income, and average number of lactating animals among producers assisted by IDR-PR in the municipality of Realeza (PR), 2023.

Variables	Frequency
Farm Size (hectares)	
Up to 10.9	9.52% (2/21)
11.0 to 15.9	19.05% (4/21)
16.0 to 20.9	28.57% (6/21)
21.0 to 25.9	9.52% (2/21)
26.0 to 40.9	19.05% (4/21)
41.0 to 80.0	14.29% (3/21)
Average Monthly Gross Income from Dairy Production	
Less than BRL 1,000.00	0% (0/21)
BRL 2,000	4.76% (1/21)
BRL 2,100 - 5,000	19.05% (4/21)
BRL 5,100 - 8,000	14.29% (3/21)
BRL 8,100 - 10,000	9.52% (2/21)
BRL 10,100 - 15,000	4.76% (1/21)
Above BRL 15,100	47.62% (10/21)
Average Number of Lactating Cows	20.86 ± 11.35

Source: The authors (2023).

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Data from the Agricultural Census (Instituto Brasileiro de Geografia e Estatística, 2017) indicate an aging rural workforce, with only 5.44% of producers under 35 years of age and 41.9% over 55. The production value of assisted farmers also differs from the census average: in 2017, 26.78% of dairy farms reported annual revenues exceeding BRL 100,000. In the present study, more than half of the properties reported annual revenues above this threshold. Technical assistance has been shown to result in significant increases in farmers' income, highlighting the effectiveness of rural extension services as instruments of income generation (Rocha Junior et al., 2020). Similarly, Cruz et al. (2021) found that higher household income levels are associated with greater access to rural extension services and agricultural financing programs.

However, similarities were observed between the overall family farming population and the study sample with respect to total farm size, producers' educational attainment, and the average number of lactating cows per property (Instituto Brasileiro de Geografia e Estatística, 2017).

Silva et al. (2022) reported that family farming in Southern Brazil has been experiencing demographic aging alongside generally low levels of formal education. They further noted that higher-income segments of family farming tend to have better access to financing policies and technical assistance. In the present study, there may be a relationship between extension work and farm performance, suggested by the absence of differences in education levels, farm

size, and average number of milked animals. Notably, however, the assisted population was younger than the broader family farming population of the municipality.

Among respondents, 52.38% reported being familiar with the National Policy for Technical Assistance and Rural Extension (PNATER) and were therefore classified as having adequate knowledge of government-provided extension services. Conversely, 23.81% were unaware of the policy, and another 23.81% had heard of it but did not know what PNATER entailed (Table 3). During questionnaire administration, a pattern emerged in which producers who reported knowledge of the policy attributed their understanding to IDR-PR guidance on their farms, training courses, and other communication channels.

Regarding attitudes, all participants believed that rural extension work contributes to farm development. However, 61.90% stated that larger farms with greater financial resources would not necessarily derive greater benefit from extension recommendations.

Among interviewed producers, 80.95% reported maintaining a good relationship with their extension technician, openly sharing experiences and opinions. Additionally, 90.48% explained to the technician the reasons for disagreeing with specific recommendations, indicating an active dialogical process. Although 66.67% did not adopt all technical recommendations, the same proportion (66.67%) received guidance from IDR-PR for adopting most of the production technologies used on their farms (Table 3).

The process of technology transfer is grounded in the interaction of a triad of actors: researcher, extension agent, and rural producer. The findings suggest that producers do not act passively in this process; rather, they collaboratively construct, together with extension agents, the pathways for adopting and adapting new production techniques. This interpretation aligns with Zuin et al. (2011), who argue that extension agents cannot effectively change farmers' attitudes without first understanding their worldview and engaging with them in their social and cultural totality.

Table 3 – Practices adopted by producers assisted by IDR-PR under the rural extension program in the municipality of Realeza (PR), 2023.

Practices Related to Rural Extension Activities	
Do you feel comfortable discussing production-related issues with the extension technician, or do you prefer simply to listen to the professional's guidance?	
Yes, I like to share my experiences and opinions	80.95% (17/21)
No, I prefer only to listen to what the technician has to say	19.05% (04/21)
What do you do if you disagree with a technical recommendation?	
I explain to the technician why I disagree	90.48% (19/21)
I remain silent	9.52% (02/21)
Do you adopt all recommendations provided by IDR-PR technicians?	
Yes, I adopt all recommendations	33.33% (07/21)
No, I do not adopt all recommendations	66.67% (14/21)
Do more than half of the production technologies used on your farm result from guidance provided by the IDR-PR extension program?	
Yes	66.67% (14/21)
No	33.33% (07/21)

Source: The authors (2023).

A statistically significant association was observed between knowledge, attitudes, and practices regarding the adoption of technical recommendations by rural producers. Among those classified as having adequate knowledge, the prevalence of adequate practices was 2.273 times higher (95% CI: 1.04–4.97) compared to those with inadequate knowledge. Similarly, among producers

with adequate attitudes, the prevalence of adequate practices was 2.26 times higher (95% CI: 0.90–5.69) than among those with inadequate attitudes (Table 4).

Table 4 – Association between Knowledge, Attitudes, and Practices among producers assisted by IDR-PR under the rural extension program in the municipality of Realeza (PR), 2023

Practices	Adequate		Inadequate		Prevalence Ratio	p
	Frequency		Frequency			
	Absolute	Relative	Absolute	Relative		
KNOWLEDGE						
Adequate	10	90.91%	1	9.09%	2.273 (1.04–4.966)	0.018
Inadequate	4	40%	6	60%		
ATTITUDES						
Adequate	11	84.62%	2	15.38%	2.256 (0.8956–5.685)	0.012
Inadequate	3	37.50%	5	62.50%		

p: Mann–Whitney U test.

Source: The authors (2023).

When comparing the variables adequate and inadequate knowledge, a statistically significant association was observed with adequate and inadequate practices ($p < 0.05$). The same pattern was found when comparing adequate and inadequate attitudes with practices ($p < 0.05$). Thus, testing these variables made it possible to assess the producer's capacity to adopt new production practices when they are knowledgeable about rural extension and recognize the role and potential of technical assistance.

It was observed that farms familiar with rural extension strategies and engaged in its methodological processes adopted a greater number of techniques as a result of follow-up ($p < 0.05$). Even so, these properties also exhibited greater resistance to fully adopting recommendations. Wagner (2011) argues that rural extension is an important instrument for social development—particularly for family farming—because it enables close engagement with rural populations through diverse methodologies.

Communication between technician and farmer cannot be reduced to the mere transfer of scientific terminology. Both actors must understand the meaning of the language being used. Therefore, integrating rural producers into participatory learning practices that foster dialogue and exchange of experiences enhances the effectiveness of technical work. Moreover, it promotes a sense of appreciation among producers by allowing them to share ideas, experiences, and knowledge (Freire, 1979; Griebler et al., 2018).

Extension services must tailor their approaches to different audiences, strengthening dialogue between technicians and producers (Taveira & Oliveira, 2008). Such adaptation leads to improved outcomes, as exemplified by the *Balde Cheio* Program in Valença (RJ), organized by EMATER, which seeks to rebuild rural pride and foster the development of family farming households (Borges et al., 2016).

Rural extension has the capacity to influence production practices, even in the presence of human and budgetary constraints. Gomes et al. (2018) reported that extension projects can lead to increases in production and productivity. To achieve optimal outcomes, rural extension programs require continuous follow-up, service quality, and property-specific planning.

The findings of this study demonstrated that producers do not believe that large landholdings or substantial financial resources are prerequisites for benefiting from extension services, a conclusion supported by the association between attitudes and practices. Greater success in follow-up may therefore be achieved if extension methodologies are adapted to different production contexts.

Perceptions of success in rural life warrant further scientific investigation to clarify how this concept is understood from the perspective of the primary actors—rural producers themselves. Although success is often intuitively linked to profitability, it is essential to consider lifestyle, culture, and attachment to land (Ramírez-Gómez et al., 2025).

Freitas et al. (2021) argue that larger farms operated by producers with higher levels of education, greater economic assets, and qualified labor still tend to achieve more growth through extension work. However, in the present study conducted in Realeza (PR), farm size and educational level were not associated with higher production levels, although assisted properties displayed higher production compared to the broader family farming population of the municipality.

Additionally, results showed that most assisted producers did not adopt all technical recommendations. Nevertheless, the majority recognized that technical guidance underpinned most of the practices implemented on their farms. During questionnaire administration, it was observed that some producers did not feel fully assisted by the extension agency, an issue that may be more accurately measured in future research. Factors potentially limiting visit frequency include the ratio of technicians to farms and the bureaucratic workload borne by extension agents.

Producers enrolled in the state rural extension program exhibited similar patterns in the adoption of certain technologies. Regarding milking management, 52.38% reported using paper towels and antiseptic solutions before and after milking (pre- and post-dipping) for teat hygiene; 66.67% regularly used the California Mastitis Test (CMT) to diagnose subclinical mastitis; 38.10% used a strip cup with a black background to detect clinical mastitis; 100% used hot water and alkaline and acid detergents to clean equipment; and 85.71% filtered milk before storage in bulk cooling tanks.

The adoption of milking management technologies may be associated with compliance requirements established by Normative Instructions Nos. 76 and 77 of the Ministry of Agriculture, Livestock, and Food Supply (Brasil, 2018a, 2018b). Producers who fail to meet standards for somatic cell count (SCC) and total bacterial count (TBC) are prohibited from commercializing their milk, thereby incentivizing the adoption of quality-control practices.

With respect to herd management, 66.67% of producers reported not monitoring heifer weight; 90.48% performed navel disinfection at birth; 95.24% provided maternal colostrum to calves; 52.38% vaccinated against reproductive diseases; 100% regularly administered anthelmintics and controlled ectoparasites while providing mineral supplementation; and only 14.29% implemented prepartum diets using anionic salts.

A discernible pattern emerges in the selection of herd management techniques. Some practices are described as long-standing methods, often learned from previous generations. There appears to be resistance toward practices requiring greater technical knowledge or higher operational costs. Conversely, practices grounded in prior knowledge tend to be more widely adopted.

Legal requirements may decisively influence the adoption of certain practices, while others are linked to inherited knowledge or time constraints. The methodological capacity of the extension program in which a rural family participates may shape decisions regarding more complex and potentially higher-cost practices that yield greater productive returns.

Geraldo et al. (1994) examined the relationship between extension agents' knowledge and favorable attitudes toward the adoption of a rural management program. They demonstrated a significant association between better program outcomes and technicians who possessed broader knowledge and favorable attitudes toward the initiative. Factors such as technicians' educational background, methodological capacity, frequency of visits, and availability for fieldwork are crucial for the effective development of family farming reliant on public technical

assistance. Ultimately, the success of extension services depends on both the adaptation of extension agents to the farm context and the acceptance of their work by the farming family.

A consistent and high-quality rural extension program is essential to address management and production challenges in dairy farms. Quality assistance contributes to productivity gains by improving milk quality indicators, including reductions in total bacterial count and somatic cell count, among others (Martins et al., 2011; Guimarães & Silva, 2015; Araújo & Silva, 2015; Mesquita et al., 2021).

Rural producers require not only the development of the aforementioned techniques but also additional strategies such as pasture irrigation, establishment of perennial crops, paddock subdivision, improved calf, heifer, and cow rearing practices, and integrated administrative and economic farm management. Furthermore, financing and technical assistance policies must promote sustainable and economically viable dairy production (Griebler et al., 2018; Fath et al., 2026). Ross et al. (2024) highlight the expansion of credit cooperatives that rely on local demographic and economic analyses to guide growth strategies. Rural extension programs could adopt a similar approach—understanding the specific characteristics, perceptions, and methodological possibilities of each locality.

These objectives are explicitly articulated in PNATER and constitute guiding principles that should be implemented by public rural extension services in accordance with Federal Law No. 12,188 (Brasil, 2010). IDR-PR is responsible for delivering public rural extension in the state of Paraná, with the premise of doing so in an inclusive and participatory manner that values family farming and connects farmers' needs with solutions generated by agricultural sciences, as established in State Law No. 20,121 (Paraná, 2019). As Caporal (2003) argues, public rural extension services must contribute to constructing alternative models of rural development and agriculture capable of improving living conditions for both rural and urban populations. On the other hand, rural producers depend on these services and recognize that effective extension can enhance their competitiveness (Freitas et al., 2021).

5 Conclusions

The profile of dairy producers assisted by the IDR-PR extension program in Realeza (PR) differs from that of Brazilian family farming more broadly, exhibiting higher productivity levels and a lower average age. However, similarities were observed regarding farm size, educational level, and the average number of lactating animals.

Producers who are familiar with PNATER and its objectives demonstrate greater adherence to recommended production practices, actively share their perspectives and experiences, and recognize the potential for productive improvement through the support provided by the extension agency.

The technologies adopted by assisted producers are influenced by multiple factors that extend beyond technical follow-up alone. Although some producers report a perceived lack of adequate extension support, all acknowledge receiving some form of technical guidance in the adoption of specific practices. Nevertheless, resistance to certain recommendations persists and is shaped by a range of contextual factors.

Some practices are adopted based on producers' lived experience in rural environments, whereas others are implemented in response to regulatory requirements. Practices that demand greater labor input and higher financial investment are less frequently adopted. However, the uptake of such practices depends not only on extension efforts but also on the availability of labor and financial resources.

Future research should further examine the operational capacity of extension agents in the region, as well as potential resource constraints that may hinder continuous, high-quality

technical assistance aimed at strengthening family farming. Scientific studies also play a crucial role in informing the development of public policies that incorporate producers' perspectives and consider the relational dynamics between technicians and assisted farmers.

The significance of this research lies in its contribution as an applied portrayal of a specific regional context, which may serve as a foundation for future studies in other Brazilian localities. In doing so, it can support the formulation of regionally tailored policies that address the diverse needs of family farming systems and their relationship with rural extension and technical assistance services (ATER).

Authors' contributions:

GHM: Conception/design of the study, Investigation, Formal analysis, Writing – original draft. IANJ: Formal analysis, Writing – original draft, Writing – review & editing. JC: Formal analysis, Writing – original draft, Writing – review & editing. JVP: Investigation, Writing – review & editing. APN: Conception/design of the study, Investigation, Formal analysis, Writing – original draft, Writing – review & editing.

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Conflicts of interest:

Nothing to declare.

Ethics approval:

This study was conducted after approval by the Comitê de Ética em Pesquisa (CEP), under protocol number 6.061.377.

Data availability:

The research data will be made available upon request sent to the following email address: guilherme.malinowski@estudante.uffs.edu.br, or to the Laboratório de Reprodução Animal da SUHVU-UFFS Realeza via email at: adalgiza.neto@uffs.edu.br.

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