

# Are tenancy land markets equitable? A review of the “farmer selection dynamics” in Algeria

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## Abstract

*The significant development of the commodification of agricultural land in developing countries these last decades, notably through tenancy practices, raises serious questions about the equity of its redistribution. Studies on the equity of land markets show contradictory findings. By analyzing the rental market in the large irrigated perimeter of Guelma, northeast Algeria, this article contributes to this debate by answering the following research question: are tenancy land markets equitable? To answer this question, we essentially surveyed a quarter of the landowners in the main agricultural zone of the perimeter (52/208) and the direct tenants of the surveyed assignors (30) in 2020. We found that in the irrigated perimeter of Guelma, the rental land market has led to (1) the exclusion from the production system of landowners with few resources and unable to provide the necessary means for cash crops that have technically considerably evolved, and (2) the spatial exclusion from good lands of small tenants, relatively inefficient and unable to keep up with large tenants in the level of their rental offer. We refer to this general dynamic as “farmer selection”.*

**Keywords:** Tenancy land markets, Renting, Equity, Exclusion, Poorly endowed producers, Small producers, Algeria.

## 1. Introduction

In developing countries, agricultural land has always been one of the primary sources of wealth and food security, but also of peace and social justice (Tramel, 2018). In most of these countries, its management, and sometimes even its exploitation, especially for the most productive lands, has long been ensured by the public authorities (King, 1977). Its use was generally ineffective (Chalet, 1991; Le Coz, 1991). The liberal economic reforms undertaken in these countries during the 1980s and 1990s translat-

ed into vast programs of redistribution and concession of agricultural land (Colin *et al.*, 2021). As in all economic sectors, these programs have mainly led to a significant liberalization movement of formal and informal transfer of land property and use rights. Indeed, the commodification of agricultural land has significantly emerged in recent decades in developing countries (Colin and Bouquet, 2022). More than the purchase-sale, it is a question of tenancy practices (renting and sharecropping).

In these emerging land-use forms, efficiency

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and equity do not seem automatically reconcilable (Nguyen *et al.*, 2021). The nature of this equity-efficiency relationship depends on the context. It can be positively similar when the efficiency of land markets is doubled by their equity (case of inverse size-productivity relationship), or negatively similar when ineffectiveness is doubled with inequity (inaccessibility of land to small efficient tenants) (Jin and Jayne, 2013; Macours *et al.*, 2010). The equity-efficiency relationship can also be inverse when efficient productive configurations result in inequitable situations (positive size-productivity relationship) and *vice versa*, when inefficient configurations result in equitable situations (unavailability of large plots favoring small tenants) (Hayami, 2010). While most studies on the efficiency of tenancy practices emphasize their ability to allocate agricultural land better than the purchase-sale market or even direct farming, studies on its equity reports mitigated assessments (Flower, 2018; Kijima and Tabetando, 2020). This article contributes to this debate and tries to answer the following research question: are tenancy land markets equitable?

The issue of equity is of major importance for sustainable rural development, both socially and economically. Along with efficiency, it is the main justification for public policy decisions in relation to land markets. The equity of tenancy practices, and of the land market more generally, is important especially for the inclusion of disadvantaged social groups in economic systems in rural contexts. The inequity of these practices generally leads to the exclusion of these categories, sometimes dominant. In most southern countries, where the lack of investment opportunities in rural regions makes non-agricultural conversion difficult, if not impossible, this exclusion often generates situations of poverty that can translate into social instability. Depending on the objective, public policies attempt to correct this lack of equity through various tools – establishing or stimulating the market through the implementation of dedicated credit schemes, regulating the market through the implementation of information systems, or limiting or prohibiting the market (Colin, 2014).

In the literature, the question of equity is ad-

ressed by focusing on two major aspects: (1) the nature of the inter-individual relations between tenants and assignors (existence, or not, of power or information asymmetries, and their consequences in terms of the type of contracts and their execution – price, clauses, enforcement) and (2) the land resource distribution (Léonard, 2008; Colin and Bouquet, 2022). Part of the literature on land resource distribution, in which this article focuses, demonstrates the equity of tenancy practices (Guri *et al.*, 2011; Kijima and Tabetando, 2020), while another part mentions the situations of exclusion to which some of its configurations can lead when it induces a substitution of wealthy tenants for smaller-economic scale producers (Léonard, 2008; Flower, 2018; Liu *et al.*, 2020). Exclusion by land markets may concern various types of actors (landowners, tenants, youth, women, indigenous people), may take different forms (permanent, temporary, spatial), and may be induced by various elements (demand pressure, prices, technical changes, public policy) (Colin, 2003; Colin and Daoudi, 2022).

As in most developing countries, the tenancy land market has experienced strong dynamics (changes in volumes, prices, and modalities) in Algeria in recent decades (Daoudi *et al.*, 2015; Benmihoub *et al.*, 2016). These practices were found by most of the literature to be efficient, but their equity was only briefly discussed. They are more observed in the most productive regions of the country, including old agricultural poles marked by the economic regime change, such as the large public irrigated perimeters of Bas-Chélif (northwest – Amichi *et al.*, 2015), Mitidja (north-central – Bouchaib *et al.*, 2011) and Guelma (northeast – Assassi *et al.*, 2020). On the large perimeter of Guelma, land renting, practiced on a small scale for a long time, has indeed experienced a spectacular boom in the last twenty years (Assassi *et al.*, 2020). Recent studies conducted by Assassi (2017) in this last perimeter show that the tenancy land market is dynamic and efficient, but opening up the analysis on its equity is necessary, especially given the limited investment opportunities in the country over the last ten years (economic crisis, oil price collapse, health crisis). In this perspective, we question in this article the role of the rental

market in the reallocation of land in the large irrigated perimeter of Guelma – is it an equitable or exclusive redistribution?

This article is divided into six sections. Following the introduction, the second section gives the contextual components required to interpret the results, including the organization of the research region and the issues encountered by local producers. In the third section, we developed an analytical grid based on Colin and Daoudi (2022) and Byres (1981) to correctly analyze two identified dynamics, namely the emergence of tenancy and the spatial distribution of tenants. The fourth section is dedicated to showing the used data and the completed questionnaires. Section five summarizes the findings by describing the dynamics mentioned above, the land market that enables their emergence, and the driving forces that propel them. The sixth section discusses these findings, demonstrates their contribution to part of the literature showing the inequity of tenancy land markets, and provides an essay on their conceptualization through the concept of “*farmer selection dynamics*”, which we highlight in the article.

## 2. Background

To carry out this study, we selected the irrigated region of Boumahra, the primary agricultural zone of the irrigated perimeter of Guelma, an agricultural wilaya (department) located in north-east Algeria (Figure 1). Agriculture in Guelma is

based on the production of cereals, vegetables, and processing crops, primarily processing tomatoes (henceforth referred to as tomatoes), destined for local processing plants and cultivated by producers who work informally, individually (no professional organization), primarily under contract, and are destined for local processing plants (Daoudi *et al.*, 2017; Assassi *et al.*, 2020). Cereals are grown throughout the wilaya, while vegetables and processing crops are grown in highly productive regions, namely the Guelma-Boucheougouf plain (from the wilaya’s center to the east), which is nourished by the Seybouse oued (small river) that runs through it (Figure 1).

As in the major agricultural poles in Algeria, the land configuration of the Guelma-Boucheougouf plain has been modified several times by the different agrarian reforms. These reforms can be divided into three categories, each with a clear orientation (Tatar, 2013). The socialist reforms (1962-1981), initiated after the independence, initially maintained the same colonial production structures presented in the form of large self-managed domains (500 hectares on average), ineffective and remodeled from 1972 during the agrarian revolution in the form of valorization groups (185 hectares on average). The State owned and managed these groups, but the labor and income were collective. Poorly managed, they were resized during the restructuring reforms (1982-1987) when greater freedom was given to the producers cultivating them. Their productive results were

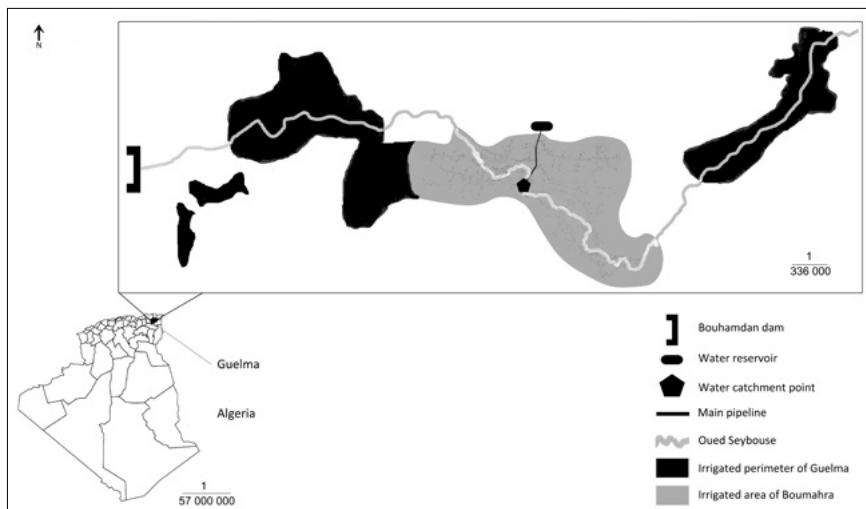


Figure 1 - Location of the study area.

far from expectations and were radically reconfigured by the liberal readjustment reforms initiated in 1988. In the Guelma-Boucheougouf plain, these reforms led to the creation of 3 pilot seed farms (4,000 hectares in total) and 138 collective farms (EAC; 40 hectares on average) and 216 individual farms (EAI; 7 hectares on average) and the restitution of nationalized lands to their private owners. The EACs and EAIs remained state-owned, but the concessionaires now entirely handle their management and exploitation (Tatar, 2013).

Since 1997, the State has steadily enhanced the irrigation capacity in the Guelma-Boucheougouf plain by establishing a vast irrigated perimeter. This perimeter, managed by the National Office of Irrigation and Drainage (ONID), currently covers an area of 9,250 hectares. Furthermore, it is fed by catchments from the Seybouse Oued, fed by water discharged from the Bouhamdane dam, located upstream (Assassi, 2017). This perimeter includes five irrigated areas, including Boumahra, our research region (Figure 1).

In 2001, the Boumahra irrigated area became operational. Like each of the other irrigated areas, it has a pump station, a reservoir, and an irrigation network. The irrigation network is made up of closed galvanized pipes buried underground, which prevents the unauthorized branches. The reservoir is located on high land, maintaining the entire network under constant pressure. Its irrigation system spans 2,400 hectares. Through irrigation terminals, the area serves 208 farms. The latter are each made up of a single plot varying in size from 0.5 to 60 hectares, with 68% being private lands, 26% being EAC (informally separated into individual farms), and 6% being EAI (Agricultural Services Directorate; ONID).

The irrigated area of Boumahra enables two irrigation seasons (seasonal and late-season crops). Irrigation is given at the producers' request, made at the start of each season. The Ministry of Water Resources has set the price of water, paid *ex-ante*, at 2.5 DZD/m<sup>3</sup>. The sums to be paid per hectare depending on the theoretical crops' consumption. In practice, the amounts of water actually used by subscribers are not measured; instead, they are determined by the volumes issued by ONID. ONID, on the other hand, meticulously examines the conformance of the crops and areas estab-

lished concerning subscriptions and connections made to irrigation terminals. When demand exceeds available quantities, the office establishes a system of water turns between the different parts of the area (ONID, 2020).

The irrigation network in the area is deteriorating, and the volumes given by the dam are sometimes insufficient to meet the demands of the subscriber producers. As a result, only a fraction of the network's surface gets watered yearly (29% in 2020 – ONID). In addition to these irrigation issues, the financial, insurance, and labor markets, particularly mechanical labor, are failing. Most farms are tiny (75% are less than 10 hectares), run by informal renters or those with no legal land tenure status, and hence lack bank credits and insurance access. The market for the sale and renting of agricultural machinery, mainly specialist machinery, is limited, and just one business represents it.

### 3. Methodology and analysis grid

The purpose of this study is to verify if the rental land market in Boumahra's irrigated area is a factor of equitable land redistribution or exclusion. The idea of equity is used in this article to refer to equitable access to, and usage of, land resources. On the other hand, exclusion is defined as the denial of access to, and use of, a resource to a group of actors based on structural criteria.

We answered our research question in four steps. To nuance the potential effects of the land market (changes), we first examined the evolution of agricultural and land dynamics in the irrigated area of Boumahra before (2000) and after (2020) the rental market boom (land use, cropping system, production system, land tenure, spatial location of different types of producers). We then described the rental market (factor of changes) in terms of structure, volumes, functioning, arrangements, prices, resulting configurations, and actors. Third, using two different but complementary analytical grids, we analyzed the driving forces leading to changes in the land access mode and the location of small and large tenants (causal relationship between factors and changes). We define small producers as all those with a total irrigated area of  $\leq 5$  hectares, and large producers as all those with a

total irrigated area of  $\geq 15$  hectares – this classification is based on local norms used by the actors and institutions of Guelma, and verified by Assassi, 2017. Finally, we consolidated all of the results through a confirmatory study carried out by comparing the agricultural and land dynamics of the studied area with those of the neighboring commune of Khezara, an area with the same pedoclimatic characteristics but which does not shelter the supposed driving forces because it is not covered by the irrigated perimeter nor crossed by a water court.

The emergence conditions of the renal land market were studied using the analysis grid of Colin and Daoudi (2022). According to this grid, which, based on empirical studies, contextualizes the theory of institutional change of Ruttan and Hayami (1984), two institutional processes are at the origin of the emergence of a land supply and demand, and therefore of its commodification: (1) individualization of plot use rights and (2) the enlargement of the bundle of rights to several elements that can be controlled by separate people and transferred separately. Colin and Daoudi (2022) relate the triggering of these two processes to the increase in land pressure and land value, which are essentially the result of demographic pressure, technical changes, and/or public policies. The authors note the necessity of a minimum of socio-economic differentiation between actors (endowments, skills, preferences) to express a supply and a demand. The entire process stimulates a “*selection pressure*” game, in which actors under financial, labor and/or technical constraints are pressured by the abovementioned changes and the existence of a land demand from other actors with a better social position and end up selling or ceding their land through tenancy practices.

We validated our interpretation of the emergence conditions of renting by a logit model. Using the landowners’ characteristics variables, this method calculates the renting probability of each landowner with a logit density function (equation 1). This allows us to determine the main structural characteristics influencing the renting out decision. The logit model for the landowner  $i$  can be expressed as:

$$PS_i = \log\left(\frac{P_i}{1-P_i}\right) = \alpha + \sum_{j=1}^n \beta x_{ij} + e_i \quad (1)$$

$PS_i$  is the dependent variable “willing to renting out land” that had two categories such as “landowners are willing to rent out land” coded as 1 and “otherwise” coded as 0.  $\log\left(\frac{P_i}{1-P_i}\right)$  is log-odd ratio. The log-odd ratio is the logarithm of the odds that a particular renting out choice will be made by the representative landowner  $i$ .  $P_i$  is the probability of proxy variable  $PS_i = 1$  and  $(1 - P_i)$  is the probability of  $PS_i = 0$ .  $\alpha$  is the intercept and  $\beta$  is the regression coefficient of the model.  $e_i$  is the error term.  $X_i$  are the independent variables which represent the different attributes affecting the representative total landowners’ willingness. Variables that may influence the renting decision used in the regression model were identified in the literature and developed through interviews with landowners and officials of local agricultural institutions. Colin and Daoudi (2022) clarified that the renting decision depends on the control of the various factors needed for self-production. The first factor is financing, expressed in the model by two complementary but different variables, the ability to self-finance owned irrigated land and credit access ability. The second factor is labor and is represented in the model by two variables, which are complementary but also different, namely age and the number of family members who can be mobilized in agriculture (labor and management capacity). The third capital concerns knowledge and is expressed in the model by the mastery degree of the new tomato technical itinerary.

The spatial distribution of the different tenants’ categories is read through the analysis grid of Byres (1981). This grid studies the substitution of poor tenants by wealthier ones, which the author refers to as “*tenant switching*”. This process nuances situations where small tenants with low financial capacities are excluded because they cannot keep up with large tenants at the level of their rental offer. This configuration is induced by the introduction of large-scale production techniques, which has accelerated in the last three decades and often requires the acquisition of new equipment (irrigation pumps, harvesters, etc.). Byres (1981) explains that, in developing countries, these techniques are relatively easier to adopt by large producers than by small ones,

given the generally high costs of such equipment, the failure of collective acquisition and management mechanisms (non-existence of professional organizations and high transaction costs), or the non-existence of a market for such services. Such configurations provide a comparative advantage to large producers, allowing them to have better access to land.

We validated our observations regarding the spatial distribution of the different tenant categories by using an analysis of variance (ANOVA) to test the dependence of the quantitative variable “area of tenants’ farms” and the qualitative variable “quality of the plots they occupy”.

#### 4. Data and surveys

The implementation of the abovementioned methodological approach required the collection of secondary and primary data. The secondary data concern (1) the Guelma irrigated perimeter and the Boumahra irrigated area (structure, functioning, water allocations, irrigated areas, land use, production system in 2000 and between 2016 and 2020), provided by the ONID of Guelma, and (2) landowners in the Boumahra area (names, status, owned areas – only irrigated or irrigable areas are considered in this article), provided by the Agricultural Services Directorate of Guelma. We define “landowner” as anyone whose activities on land are “socially authorized” (Demsetz, 1967), which includes EAC and EAI concessionaires.

The primary data essentially concern the land market (structure, modalities, functioning, prices) and its actors (profiles, farms – one or several plots of land exploited by a single person –, land endowments, production logics over time, resource endowments, plots quality, productive and economic performance). These data were obtained through semi-structured interviews with Agricultural Services Directorate and ONID officials and a questionnaire survey, which involved 52 randomly selected landowners in the Boumahra irrigated area, representing 25% of the total landowners in the study area in 2020 (208 landowners), and 30 tenants, namely all the direct tenants of the surveyed landowners who rent out. To carry out the confirmatory study,

we benefited from the data of Guesmia Nesrine (student at the ENSA of Algiers) concerning 16 landowners of the control commune of Khezara, randomly selected following the snowball method – one respondent leads to another. All surveys have 2020 as a reference period.

#### 5. Results

Our results show that in the irrigated area of Boumahra, the rental land market has led to the exclusion of landowners with few resources and small tenants, a general dynamic that we refer to in this article as “*farmer selection*”. More broadly, this dynamic is characterized by global and temporal processes in which the emergence of a competitive market in contexts where land is highly productive but becoming scarce, favors producers with the structural characteristics that allow for the best land-use, allowing them to resist the growing competition, and gradually excludes other producer categories that do not have the required characteristics. In the study area, first, the introduction of irrigation in 2001 led to a better valorization of its land by making it possible to cultivate high value-added crops, especially processing tomatoes. This has encouraged agricultural investment and has greatly boosted the rental market by exerting “*selection pressure*” (Colin, 2003) on landowners under constraints, particularly financial constraints, leading to their substitution by better-endowed tenants. Second, between the 2000s and 2010s, the deterioration of the irrigation network and overexploitation of the most accessible plots fragmented the land market. The rented lands and their rental prices were therefore differentiated according to their irrigation security degree and their fertility. According to the “*tenant switching*” process (Byres, 1981), this segmentation has led to a spatial exclusion of small tenants from the best water-served and less exploited lands by larger and more efficient tenants.

##### 5.1. Agricultural and land dynamics in the irrigated area of Boumahra: major changes

Before their planning and equipment with irrigation network in 2001, the 2,400 hectares of the

current irrigated area of Boumahra were mainly dedicated to rain-fed cereal cultivation (80%), practiced in an annual rotation wheat/fallow (ONID, 2020). Tomato was grown on the sides of the Seybouse oued, which crosses the commune from north to south (Figure 1), on small areas corresponding to 2% of the total area of the current irrigated area of Boumahra (ONID, 2020). It was grown in rotation with cereals one year in three, in a semi-intensive mode; fixed varieties with low yields and low fertilizer (2.5 quintals/hectare – unreferenced data are from our surveys) and water inputs (3 irrigations). The agricultural lands were mainly worked in direct tenancy. Renting concerned less than 5% of the land of the current irrigated area, especially those near the oued, representing 23% of the same area (ONID, 2020). Small and large producers, primary landowners, had similar proximity to the Seybouse oued, the primary source of irrigation in this period; respectively 3.2 km and 3.9 km on average (Agricultural Services Directorate, 2020).

According to our surveys conducted in 2020, cereals currently occupy less space (28%), while tomato, which can now be grown throughout the whole region, covers 32% of its total area. Vegetables, fruit trees, and processing chili pepper occupy 35%, 3%, and 2%, respectively. Cereals are sometimes rain-fed and other times grown semi-intensively (low fertilizer inputs and supplemental irrigation). Tomato production is totally intensive, both in terms of labor and capital; use of high-yielding hybrid varieties by all, and significant

inputs of fertilizer (12 quintals/hectare on average) and water (13 irrigations on average). Like all Solanaceous crops grown in the region, tomato is grown in rotation with cereals one season in two.

Our findings show that in 2020, 62% of the surface of the irrigated area (465 of the 750 hectares covered by the survey), owned by 58% of the surveyed landowners, was farmed through tenancy practices. The area cultivated by tenants has been multiplied by thirteen in less than 20 years.

Small and large tenants, each representing 40% of the surveyed tenants, do not have a similar spatial distribution. Compared to the small ones, the large tenants occupy the best lands. It should be noted that in the study region, the quality of the plots is measured by (1) their fertility, which depends on the previous crop, the soil type and especially the number of years of intensive farming, and (2) their access to irrigation water, determined by their proximity to permanent irrigation sources. Based on these two criteria, the plots in the area can be divided into three categories, namely (1) fertile and well water-served plots (Class A), (2) fertile plots but without secured irrigation access (Class B), and (3) low-fertility plots with insecure irrigation access (Class C).

In 2020, 50% of the large tenants surveyed occupied class A plots, and only 17% of them occupied class C plots. On the other hand, only 8% of the small tenants surveyed occupied class A plots, and nearly 60% of them occupied class C plots (Figure 2).

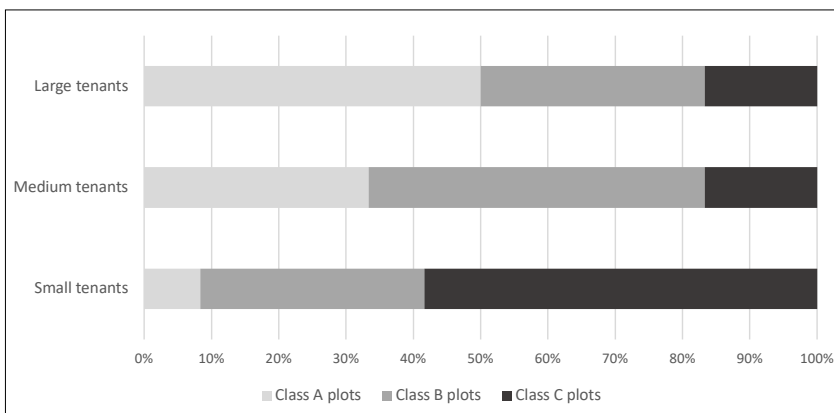


Figure 2 - Positioning of the three tenants' categories in the different land classes.

## 5.2. Rental land market in the irrigated area of Boumahra: structure and functioning

In the irrigated area of Boumahra, the rental land market comprises two segments. The first one, the most important (90% of the area rented by the landowners surveyed in 2020), corresponds to the market of plots destined for irrigated crops (irrigated land market), and the second one corresponds to the market of plots destined for non-irrigated crops (irrigable land market). According to the dominant annual rotation system in the region (irrigated/rain-fed crops), lands change category each year. For both market segments, renting is done by season. Its duration depends on the crop; six months for the tomato and eight months for the wheat. The rental contracts are informal and are concluded orally between the tenant and the assignor. The rental of EAC and EAI plots is legally prohibited (Assassi *et al.*, 2020).

The rental price, paid in cash *ex-ante*, reflects supply and demand. In 2020, it was on average 90,000 DZD/hectare. This price is not the same for all plots. It varies from 30 000 DZD/hectare to 150

000 DZD/hectare, depending on the land category of the plots and their quality. In 2020, the average rental prices of irrigated and irrigable plots were 93,000 DZD/hectare and 45,000 DZD/hectare, respectively. The average rental prices for class A, B, and C plots were 118,000 DZD/hectare, 89,000 DZD/hectare, and 86,000 DZD/hectare, respectively. Producers accept to pay more for good lands because it allows them to improve their profits by increasing their yields and/or reducing their costs; (1) lands with secured access to water allow them to irrigate more (+3 irrigations on average for tomato), (2) lands with a different family crop as a preceding crop allow them to reduce the number of chemicals treatments (-3 treatments on average for the same tomato yield), (3) lands with loamy soil allow them to reduce the fertilizer quantity (-3 quintals/hectare on average for the same tomato yield) and (4) less exploited lands allow them to achieve a higher yield (+20 tons/hectare on average for tomato produced on plots intensively exploited for less than 10 years compared to those intensively exploited for more than 10 years).

Table 1 - Mean comparison of the surveyed actors.

	All respondents		Assignors		Landowners self-producing			Tenants		
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	t-value (comparison with assignors)	Mean	Std Dev	t-value (comparison with assignors)
Age of head of household (years)	58	11	63	12	54	12	2.41	56	5	2.64***
Number of household members that can be mobilized in agriculture	1.15	1.50	0.50	1.25	1.18	1.37	-1.87	1.77	1.59	-3.43***
Own irrigated area (hectare)	10	16.2	15.5	18	12.9	19	0.48	1.5	3.63	4.06***
Area of tomato that can be self-financed (hectare)	4	4	1.9	1.9	4	4	-2.21**	5.3	4	-4.03***
Total net income (millions DZD/year)	3	2.99	1.59	1.76	3.13	3.22	-2.21**	4.31	3.24	-4.03***
Ownership of a tractor (dummy)	0.68	0.47	0.40	0.50	0.82	0.39	-3.26***	0.87	0.35	-4.21***
Tomato yield (tons/hectare)	74.6	12	/	/	73.4	15	NR	73.9	14.6	NR
Wheat yield (tons/hectare)	3.7	0.7	3.6	0.5	3.8	0.4	-1.65	3.7	1.1	-0.67***
Number of respondents	82		30		22			30		

Levels of significance: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ .



The combinations of assignors-tenants are varied. Four main configurations are distinguished based on irrigated area, namely (1) small landowners transferring to large tenants (30%, *reverse tenancy* – Colin, 2014), (2) small landowners transferring to small tenants (17%), (3) large landowners transferring to small tenants (13%), and (4) large landowners transferring to large tenants (7%). Moreover, in contrast to the assignors, who are often under financial and/or labor constraints, the tenants surveyed, mostly from Guelma (96%, different communes), are financially well endowed, have a large economic scope, have a large labor force and are more efficient (Table 1). For their part, landowners who self-farm their lands (42% of surveyed landowners) have characteristics and performance more or less similar to those of tenants (Table 1).

### 5.3. Driving forces of the productive dynamics in the irrigated area of Boumahra: “farmer selection” dynamics

The productive dynamics in place result from two processes related to the rental land market, triggered successively, namely its development and segmentation. These processes have led to a large “farmer selection” movement, consisting of a sorting out in several phases, favoring the most performing producers’ category each time.

#### 5.3.1. Emergence of renting and substitution of landowners under constraints

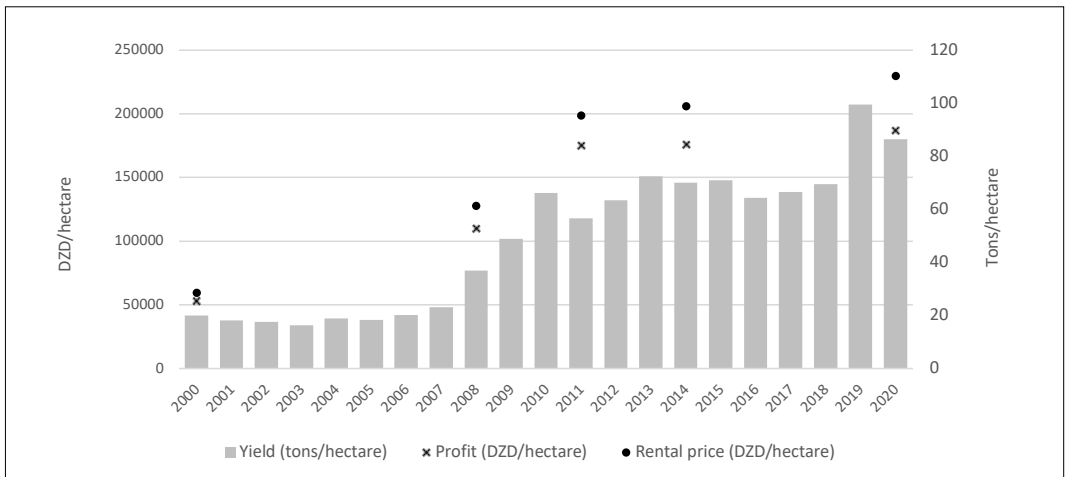
The opening of the Boumahra irrigated area in 2001 (ONID, 2020) made it possible to expand the tomato area. More profitable, the tomato has gradually replaced cereals. The intensification of its technical itinerary accelerated this process following the introduction of numerous technical innovations (high-yielding hybrid varieties, mechanization, industrial plants) and improved coordination within the sector thanks to the generalization of contract farming from 2009 (Assassi *et al.*, 2020). Tomato yield increased from 20 tons/hectare in 2000 to 86.5 tons/hectare in 2020 (Figure 3). In constant dinar (base 2001 = 100), net profit per hectare of tomato increased from 53,000 DZD in 2000 to 187,000 DZD in 2020, which is currently nearly five times more than wheat (Figure 3).

The improvement of land productivity has attracted to the irrigated area producers with many financial resources but with few or no own irrigated plots (Table 1). To access irrigated land, they, therefore, resort to rents. The tenants have different profiles (Figure 4) but rent land mainly to produce tomatoes (96%).

#### a) Tenants without own irrigated land

This category includes four profiles: (1) outsider investors (relative to agriculture) who have

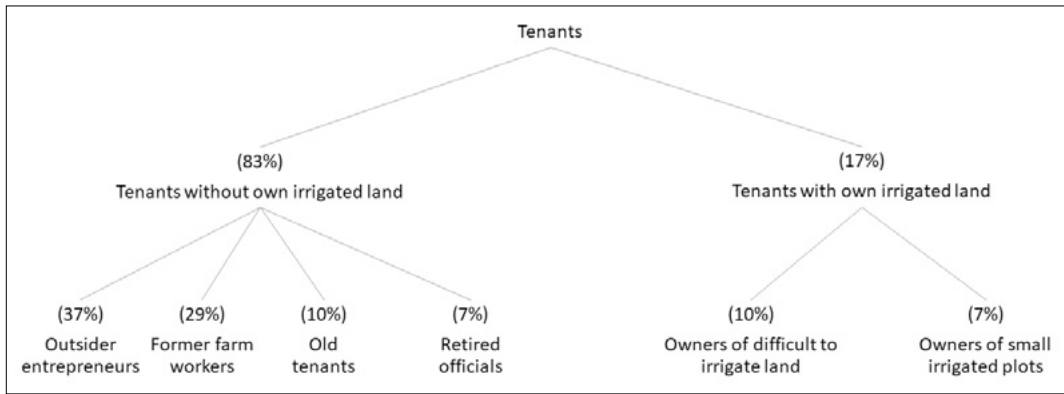
Figure 3 - Evolution of land rental prices, yields, and profits per hectare of processing tomato between 2000 and 2020.



Source: Ministry of Agriculture (from 2000 to 2020); ONID (2000, 2008, 2011); Assassi *et al.*, 2020.

Note: Profits and rental prices are presented in constant dinar, base 2001 = 100.

Figure 4 - Classification of the tenants of the irrigated area of Boumahra in 2020.



constituted financial capital in other activities, notably trade, (2) former farmworkers who have worked for tomato producers, (3) producers who have always farmed on rented land, and (4) retired officials, all from rural regions.

**b) Tenants with their own irrigated land**

This category includes two profiles, namely (1) former producers, who mainly grew cereals, and who own difficult or non-irrigated land (outside the irrigated perimeter), and (2) former tomato producers who own irrigated plots (9 hectares on average) that are insufficient compared to their current significant needs for irrigated land (27 hectares on average).

The high demand expressed by the tenants has considerably increased the rental rent. This rent has increased sevenfold in constant dinar between

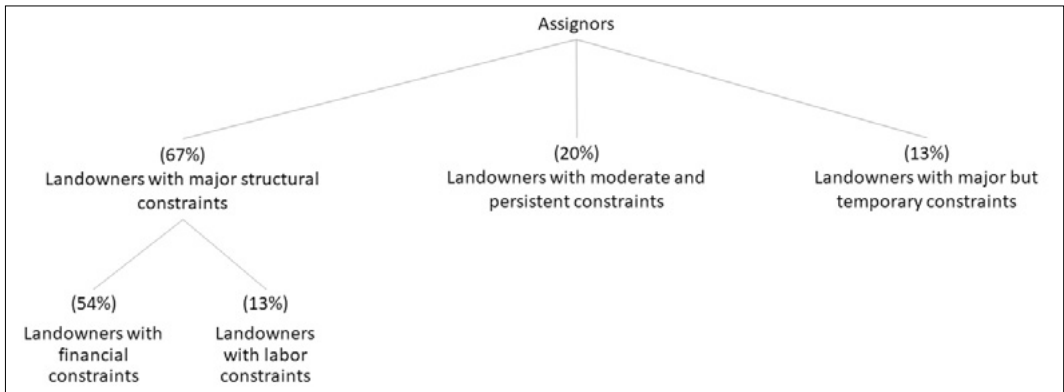
2000 and 2020 (Figure 3). The increase in rental prices and the development of tomatoes, followed by the increase of its financial and labor requirements, led landowners under financial and labor constraints to rent out their plots – a “*selection pressure*” game (Colin and Daoudi, 2022). Indeed, the logit model (Table 2) shows that the decision to rent out is determined by the age and number of household members that can be mobilized in agriculture (synonym of the available labor force) and in particular by the landowner’s financial capacity. Having the resources to self-finance irrigated plots eliminates the possibility of renting out completely. Increasing the age of the head of household by one year increases the probability of renting out by 6.2%. On the other hand, the latter decreases by 44.2% with the existence of a single-family member who can be mobilized in agriculture.

Table 2 - Logit model of rental practice by landowners.

	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>Df</i>	<i>Sig.</i>	<i>Exp(B)</i>
Financing capacity of the owned irrigated plots (dummy)	-1.732**	0.775	5.002	1	0.025	0.177
Age of head of household (years)	0.062**	0.031	3.879	1	0.049	1.064
Number of household members that can be mobilized in agriculture	-0.442*	0.259	2.920	1	0.088	0.643
Control of the new tomato technical itinerary (dummy)	-0.203	0.773	0.069	1	0.793	0.816
Ability to access credit (dummy)	-0.479	0.735	0.424	1	0.515	0.619
Constant	0.533	2.550	0.044	1	0.835	1.703
Model correct predictions (%)	76.9					
Adj R-squared	0.429					
Number of observations	52					

Levels of significance: \**p* < 0.1; \*\**p* < 0.05; \*\*\**p* < 0.01.

Figure 5 - Classification of the assignors of the irrigated area of Boumahra in 2020.



However, not all assignors practice renting the same way. Depending on the significance and persistence of their constraints, they can be divided into three groups, each of which adopts a different renting logic over time (Figure 5).

#### *a) Landowners with significant structural constraints*

The landowners of this group completely rule out the possibility of directly farming their land. They, therefore, rent out their plots permanently. A tomato/wheat rotation is ensured on their land under tenancy practices.

Most of the landowners in this group have significant financial difficulties. They cannot self-finance tomato production (810,000 DZD/hectare for hybrid varieties and 250,000 DZD/hectare for fixed varieties), do not have alternative sources of financing (individuals and banks), and are very averse to debt risks. Their low technical skills amplify their risk aversion. Tomato production is therefore not envisaged. Likewise, the income from renting for cereal production (45,000 DZD/hectare), which is secure, immediate, and without cost or effort, is preferred to the profits they can make from their direct farming by producing wheat (85,000 DZD/hectare), which is a little higher, but which requires the immobilization of a sum of money for a season and implies credit, labor, and risk costs, very high in their case.

Other landowners in this group, less numerous, who have the necessary financial resources and a good technical knowledge of the tomato, but who have other activities and no household members that can be mobilized in agriculture, also practice

permanent renting. The assignors in question are former tomato producers who have left the perimeter for more lucrative activities (trade). Their direct involvement in agricultural production is not possible. In the same way, they prefer renting out to self-production by adopting other farming forms that would allow them to overcome their labor constraints. For example, hybrid tomato production via sharecropping would allow them to make a net profit of 260,000 DZD/hectare (Ouendeno *et al.*, 2015), but involves risk and management costs for sharecroppers and requires the immobilization of a large sum of money that they would prefer to engage in their main activities.

#### *b) Landowners with moderate and persistent constraints*

The landowners of this group cannot self-finance tomato production. However, they can self-finance cereal production, which is less risky and requires less labor and capital (95,000 DZD/hectare). Thus, in a cyclical process, they rent out their plots one year for tomato production and recover them one year for durum wheat production through direct farming. Thus, they took advantage of the fertilizer inputs provided by tomato producers to realize relatively high yields (3.7 tons/hectare).

#### *c) Landowners with significant but temporary constraints*

Landowners in this group face significant temporary financial constraints, often due to unforeseen off-farm expenses. During the concerned periods, they rent out their plots occasionally, generally one or two seasons, and recover them

Table 3 - Dependence analysis of area and plot class variables - ANOVA test.

<i>Area</i>	<i>Sum of squares</i>	<i>df</i>	<i>Mean square</i>	<i>F</i>	<i>Sig.</i>
Between groups	1,428.462	2	714.231	3.815	0.036
Within groups	4,681.003	25	187.240		
Total	6,109.464	27			

for continuous production in direct farming (tomato and cereals) once their constraints are overcome. This allows them to valorize their land even during difficult periods and ensures them access to important rental income.

### 5.3.2. Land market segmentation and spatial isolation of small tenants

The ANOVA test confirms the relationship between the size of tenants' farms and the quality of the land they occupy (Table 3).

The better positioning of large tenants in relation to the best lands (Figure 2) is because the rental market is segmented by water and plots' fertility. In contrast to other relatively accessible production factors, in the study region, water and suitable land are the most limiting factors for tomato production, the main crop in the area, which has significant water and fertility requirements. Water is currently only available on the irrigated perimeter and Seybouse oued. Drilling is strictly forbidden, practically non-existent, and not possible for seasonal tenants. Given the pyramidal structure and damaged state of the irrigated area, the plots it covers do not all have the same access to water (Figure 1). Those fed by irrigation terminals close to the main pipe of the irrigated area, not concerned by the practice of water turns, are the best served. The plots that were previously easy to irrigate, especially those near the Seybouse oued, have been intensively exploited for several decades. They are currently not very fertile and are more favorable to disease development. Their recovery requires a resting period of 10 to 15 years. Lands that combine the two desired characteristics of fertility and water access security have become rare. Competition for these lands is fierce, which increases their rental price. Large tenants offer relatively higher prices and therefore access better lands. The average rental price paid by these tenants in 2020 is 104,000 DZD/hectare, 40% higher than that paid by small tenants in the same year (74,000 DZD/hectare).

The greater competitiveness of large tenants, due to the economies of scale they realize, explains their ability to offer higher rental prices. Their production costs are lower (7 DZD/kg against 9 DZD/kg for small tenants). This difference is mainly the result of the use of own transport means and the mechanization of tomato planting and harvesting, which reduce the total production cost by 20% in average. Acquiring a transport mean and mechanizing these two operations is not possible for small producers. The purchase of a truck (5 million DZD), a transplanter (750,000 DZD), and a harvester (12 million DZD) requires significant financial resources and cannot be rationalized in small areas. For economic reasons (travel cost/profit), the only provider of this service in Guelma rents transplanters and harvesters only to large producers (minimum 10 hectares of tomato). Therefore, small producers are forced to engage service providers to transport their goods and employees to plant and harvest their fields manually.

A circular dynamic further reinforces the land configuration resulting from the segmentation of the rental market. The good lands that large tenants can obtain, thanks to their better competitiveness, improve their yields more (85 tons/hectare against 70 tons/hectare for small tenants in 2020) by allowing them to take advantage of their fertility, irrigate more and reduce the risks of water availability, which encourages investment in the other production factors (capital and labor).

This circular dynamic amplifies the spatial isolation of small tenants. The better performance of the large tenants allows them to make more significant area expansions. In five years, they increased their irrigated area by an average of 12 hectares, while small tenants increased it by an average of only 0.23 hectares during the same period. Large tenants achieve this land concentration through the tenancy practices by renting more fertile and well water-served lands.

#### 5.4. *Confirmatory study*

Our surveys in the neighboring commune of Khezara demonstrate the impact of the rental market on small producers' place in local agriculture. Khezara landowners have similar structural characteristics to Boumahra landowners (on average, 60 years old, 8.5 hectares of owned land, the ability to self-finance 2.5 hectares of tomato production, and one family member who can be mobilized for agriculture), behave very differently. In 2020, only 6% of them produced tomatoes. Tomatoes have thus occupied only 3% of the commune's agricultural land, while wheat is still the most important crop and lands used for agriculture are less profitable.

Rental prices are significantly lower (15,000 DZD/hectare) than those practiced in Boumahra. Thus, Khezara's landowners prefer to produce rain-fed cereals, making an average net profit of 54,000 DZD rather than renting out their plots. Between 2014 and 2020, renting was only practiced once by a single landowner. In 2020, all surveyed landowners directly exploited their plots. When they are rented (rarely), the lands of the commune have almost the same rental value. The limited rental market of Khezara is homogeneous. Rental prices vary only slightly depending on the accessibility of the plots. The standard deviation of prices practiced in Khezara in 2020 by the closest assignors to the surveyed landowners is 5,500 DZD/hectare, while the standard deviation of prices practiced in Boumahra the same year is 31,000 DZD/hectare. The purchase-sale market is almost non-existent.

#### 6. Discussion and conclusion

In addition to its role in the development processes of developing countries, marked by the failure of insurance and social security systems, agricultural land also plays an essential role in maintaining social peace (Colin and Daoudi, 2022). The significant emergence of its commodification in recent years, mainly through tenancy practices (rental and sharecropping), raises serious questions about the equity of its redistribution. Studies on the equity of the tenancy practices show contradictory findings. By analyzing the rental land market in the

Boumahra area of the large irrigated perimeter of Guelma (northeastern Algeria), this article contributes to this debate. It attempts to provide a prefiguration of the logical links between a combination of contextual elements and the tenancy land markets' equity (or not).

Following some of the literature noting the inequity of tenancy land markets (Flower, 2018; Liu *et al.*, 2020), our results show that the rental land market in the Boumahra irrigated area is, to some degree, exclusive. In this work, we have essentially documented two phenomena mentioned in the literature, each of which excludes a different producer category.

The first documented phenomenon is the substitution of better-resourced tenants for financially and labor-constrained landowners. This substitution, referred to as "*selection pressure*" by Colin and Daoudi (2022), is induced by technological change and land productivity and rental value increases. This substitution is an exclusion from the local production system for the majority of the landowners polled. This exclusion is the result of the credit and insurance markets failing. The latter's condition prevents the assignors to adequately exploiting their lands. The effect of the exclusion of constrained landowners, on the other hand, is reduced in part by the high rental prices (1) for irrigated crops due to the presence of water and (2) for rain-fed crops due to the residual fertility produced a year earlier by tomato tenants.

The second documented phenomenon concerns the isolation of small tenants from the most fertile and well water-served lands, following the "*tenant switching*" process described by Byres (1981). Also, this isolation is clearly a spatial exclusion of small tenants, unable to keep up with large tenants in the level of their rental offer. This exclusion results from the rarity of lands adapted to high value-added crops following the accentuation of irrigation problems and the overexploitation of a part of the irrigated area. This exclusion is also a consequence of the failure of the agricultural machinery market and of support mechanisms for forming professional organizations, preventing small tenants from mechanizing some operations and improving their competitiveness in the same way as large tenants. The significant expansions that large

tenants achieve through the rental market can transform the spatial isolation of small tenants into a total exclusion from the high-value irrigated crop production system.

The cross-referencing of our results with those obtained by other researchers makes it possible to draw more general conclusions regarding the dynamics that tenancy practices can induce under certain conditions. The withdrawal of States from direct land management has generally led to the emergence of other social rules, often informal, liberal, and recognizing the plurality and transferability of land rights. This new configuration has generally led to the emergence of competitive land markets (Colin and Daoudi, 2022), which, under certain conditions, would stimulate a “*farmer selection*” dynamic that we summarize in what follows. Developing competitive markets in contexts where land is profitable but rare leads to fierce competition for resource access. Thus, a global dynamic of natural selection takes place. Producers who can make the best land-use resist this competition and can enter and/or maintain themselves in the production system. The actors’ capacity to make the land profitable is often differentiated by structural characteristics (farm size, availability of family labor, financial endowments, age, etc.). The nature of the required characteristics changes from one context to another, depending on the crops, the institutional environment, and the nature of the credit, insurance, input, and output markets. Thus, under these conditions (competition and rare productive lands), tenancy land markets would lead to a gradual exclusion, complete or partial, of producers who do not have the required structural characteristics.

Despite its coherence, the concept of “*farmer selection*” is only developed here on an experimental and essayistic basis. Indeed, its validation requires its testing through other empirical works. However, this does not make it any less relevant to the case study, where it allows us to understand the temporal dynamics of exclusion of several producer categories. However, the obtained results can only be used as a reliable decision-making tool if other complementary economic and social readings accompany them. More work is required to place the documented

exclusion in a broader context and to provide a critical reading. Other research questions concerning the categories of producers excluded (evolution of total income, social classes, economic activities, logic over time) and included (sector of origin, profiles: opportunists, occasional, permanent) as well as local investment opportunities must be addressed in order to verify its problematic character, or not, in terms of justice and social peace.

On the other hand, it is clear that these forms of exclusion can be attenuated by reducing the gap between the producers favored by such configurations and those affected by it. Indeed, some research documents tools used by governments in other contexts to address unequal access to land. These tools, of varying effectiveness, can be divided into two categories according to their objective. Some tools aim to improve access to land for poorly endowed producers by improving their access to efficient technologies. This can be done on an individual way, for example by easing the conditions for access to credit, especially from public banks, or by setting up loan guarantee schemes (Holden *et al.*, 2009). It can also be done in a collective way by providing sufficient incentives for the development of agricultural organizations that allow for the emergence of joint farming, which makes the collective adoption of innovations possible (Colombo and Perujo-Villanueva, 2017; Perujo-Villanueva and Colombo, 2021). Other tools aim instead to reduce access to land for categories of producers likely to compete with producers under constraints. This can be done in particular through market regulation, by establishing a fiscal policy that allows it, by securing transactions, by regulating prices, or by favoring certain tenants (Holden *et al.*, 2014). To do so, the state can also circumscribe the market, or even prohibit it (Colin and Bouquet, 2022).

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