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## **Global problems in Agricultural mechanization system of Russian Federation.**

**The most important problem for Russian Agriculture is to recreate the Agricultural Machinery Fleet to 2020.**

**The Russian Academy of Agricultural Sciences supports the prognosis to increase considerably (in 3,5 – 6 folds) the fleet of main types of agricultural machinery from present crucial state (2012) to 2020 as follows:**

- wheeled and crawler tractors from 276,2 thous. units to 900 thous. units;**
- grain harvester from 72,3 thous. units to 250 thous. units;**
- forage harvester from 17,6 thous.units to 60 thous.units;**
- sugar-beet harvester from 2,8 thous.units to 20 thous.units;**
- potato harvester from 2,7 thous.units to 30 thous. units;**

## **Production of the key technique – TRACTORS in 2012**

**Accordingly with above it is necessary to increase also the production of the many types and many thousand units of other agricultural machines and equipments for plant production, meadows and pastures improvement, animal production, vegetables, fruits, e.t.c.**

**In reality the production of the key agricultural machines in 2012 was on the very low level:**

- domestic production of agricultural tractors was 459 units;**
- imported from Republic of Belarus - 26153 units, including the assembled in Russia from Belarus components - 14800 tractors;**
- for export - 369 units (314 wheeled and 55 track laying tractors);**

## **The Age Indicators of main types of Machinery**

**Also it is necessary to take into account that at present time in the Agricultural Machinery Fleet of Russian Agriculture there are about:**

**~ 35% of tractors of 10 - 17 years old;**

**~ 65-70% of Grain and Forage Harvesters of 10-12 years old;**

**~ 60% of Sugar-beet Harvesters (domestic production) of 8 years old;**

**~ 80% of Potato Harvesters (domestic production) of 10 years old.**

**Concerning the imported Harvesters it is necessary to point out that ~ 50% of them are above 10 years old and the level of localization of the assembled in Russia Harvesters is not more than ~ 5-20%.**

**It means that we need fulfill several main tasks:**

- to design, manufacturing and annually testing of the hundreds of new machines for all over the country which should be acceptable for the new different types of farming (agricultural enterprises, private farms, small size of population plots);**
- to certify the imported machines to choose the suitable one for every from 40-60 regions of Russia with different soil-climatic conditions;**
- to recreate the components base in Russia for industrial production of the new key machinery;**
- to recreate the professional system of preparing the high qualified tractors and harvesters operators and services for maintenance and repairing of the technique;**
- to support the agro engineering sciences in Russia and efficient cooperation with our neighbours (Belarus and Ukraine, Kazakhstan, China, India, Japan and others).**

## New Forms of Farming in Russian Agriculture

As far as the agricultural farms of different types and sizes were installed also appeared the problems for supplying them with acceptable technique and technology. The parameters of existing forms of farming and main indicators of technical provision of them are shown in. Table 1

Types and numbers of Farms	Main indicators of Agricultural production on the end of 2012				Main indicators of Agricultural production, prognosis to the end of 2020			
	Arable land, mln. hectares	Total agricultural product, %	Tractor Fleet		Arable land, mln. hectares	Total agricultural product, %	Tractor Fleet	
			thous. units	Average power, kW			thous. units	Average power, kW
<b>Agricultural Enterprises, 25 000</b>	56,7	46,7	276,2	73	90,0	77,7	900/329*	88 - 92
<b>Private farms, 240 000</b>	16,5	8,5	70,0	72,8	15,0	7,0	~400	66
<b>Families plots, ~17 mln. families</b>	3,5	44,8	412,0	2-5	5,0	15,3	2000 motobloks	12
<b>Total:</b>	76,7	100%	758,2	~ 46	110,0	100%	1300 + 2000 motobloks	

## Technical indicators of wheeled tractors in Russian tractor fleet

Table 2.

Trac- tion class	Trac- tive force, κN	Power of basic models, kW	Mass of basic models, kg	Main PTO power/ front PTO power, kW	PTO power/ Engine power,%	Front mounted system force, kN	Main mounted system force, kN
8	74	340	19000	210/-	61,8/-	90	140
6	60	260	15400	150/-	57,7/-	70	120
5	50	230	12800	135/50	58,7/21,8	65	110
4	40	180	10300	105/40	58,4/22,3	55	90
3	30	130	7700	75/30	57,7/23,1	45	80
2	20	110	5100	60/20	54,6/18,2	40	65
1,4	14	70	3600	40/15	57,2/21,5	30	50
0,9	9	40	2300	24/-	60/-	25	40
0,6	9	25	2300	15/-	60/-	20	30
0,2	2	10	500	8/-	80/-	-	8
0,1	-	5	100	5/-	100/-	-	-

# Technical data of crawler tractors in Russian tractor fleet

Table 3.

Tractor class	Tractive force, kN	Power of basic models, kW	Mass of basic models, kg	Main PTO power / front PTO power, kW		Front mounted system force, kN	Main mounted system force, kN
<b>8</b>	<b>78</b>	<b>280</b>	<b>16000</b>	<b>150</b>	<b>-</b>	<b>75</b>	<b>120</b>
<b>6</b>	<b>59</b>	<b>220</b>	<b>12000</b>	<b>120</b>	<b>-</b>	<b>60</b>	<b>100</b>
<b>5</b>	<b>49</b>	<b>185</b>	<b>10 000</b>	<b>105</b>	<b>-</b>	<b>55</b>	<b>90</b>
<b>4</b>	<b>39</b>	<b>140</b>	<b>8000</b>	<b>85</b>	<b>-</b>	<b>45</b>	<b>80</b>
<b>3</b>	<b>29</b>	<b>110</b>	<b>6000</b>	<b>85</b>	<b>-</b>	<b>35</b>	<b>70</b>
<b>2</b>	<b>20</b>	<b>70</b>	<b>4000</b>	<b>40</b>	<b>-</b>	<b>30</b>	<b>60</b>



## Comparison of technical indicators of some crawler tractors of Russia, Ukraine and Belarus

**Table 4.**

Models (types)	ДТ-75*	Т-150*	Т-4А1*	ХТЗ-181 Ukraine	МТЗ-2102 Belarus	Т-250*
<b>Mass, kg (t)</b>	<b>6180</b>	<b>7580</b>	<b>8870</b>	<b>9050</b>	<b>10800</b>	<b>12700</b>
<b>Power, kW</b>	<b>55,15</b>	<b>88,24</b>	<b>95,6</b>	<b>175,7</b>	<b>155,9</b>	<b>183,8</b>
<b>Tractive force, kN</b>	<b>40</b>	<b>49</b>	<b>57</b>	<b>58,6</b>	<b>30-50</b>	<b>82</b>
<b>Specific mass, kg/kW</b>	<b>112</b>	<b>85,9</b>	<b>92,8</b>	<b>51,5</b>	<b>69,3</b>	<b>69,1</b>
<b>Specific tractive force, kN/t</b>	<b>6,47</b>	<b>6,46</b>	<b>6,42</b>	<b>6,48</b>	<b>2, 8–4,6</b>	<b>6,46</b>
<b>Tractive efficiency, kN/kW</b>	<b>0,73</b>	<b>0,56</b>	<b>0,6</b>	<b>0,33</b>	<b>0,2–0,3</b>	<b>0,45</b>

**Working speed of Russia\* and Ukraine tractors is 5 - 8 km/h and of Belarus tractor MTZ- 2102 with tracks equipped with rubber-metal pivots up to 10-12 km/h and for transportation – up to 30 km/h.**

## Comparison of main technical requirements of the Agricultural tractors of Foreign and Domestic production and Perspective tractors

**Table 6.**

	Main indicators of technical level	Foreign tractors	Domestic tractors	Perspective tractors
1	Diapason of power, kW	5 .....440	15...257	5...400
2	Specific fuel consumption, g/kW in hour	107	120...130	125...135
3	Spare of tractor engine Moment, %	40...50	20...25	50...60
4	Time up to simple damage of engine, moto-hours	1500...2000	250...400	600...900
5	Resource of engine, thous.hours	15000...20000	6000...10000	15000...16000
6	Level of sound in cabin, dBA	70...75	80...85	70...75
7	Introduction of ecological requirements	Euro-3 ... Euro-4	Euro-1	Euro-1 ... Euro-3
8	Diapason of main working speed, km/h	Up to 40	Up to 15	Up to 20
9	Diapason of main maximum transport speed, km/h	50...60	30...40	40...50
10	Specific energy per ton of tractor mass, kW/t	17...21	13...18	16...18
11	Specific mass of tractors (without class 0,6), kg/kW: -crawler tractors -wheeled tractors	50...54 38...60	54...68 46...70	50...54 38...63
12	Electronically system of tractor control	Wide spread	Restricted	Restricted
13	Type of the transmission of tractors	Hydrostatic, double flow (cvt), electrical	Mechanical, synchronized	Hydrostatic, double flow (cvt), electrical
14	Average pressure on soil, kPa: - crawler tractors - wheeled tractors	42...50 80...120	42...55 100...145	40...50 80...120

**Production of main agricultural crops in all types of Russian Farms for 2012 \* Table 6.**

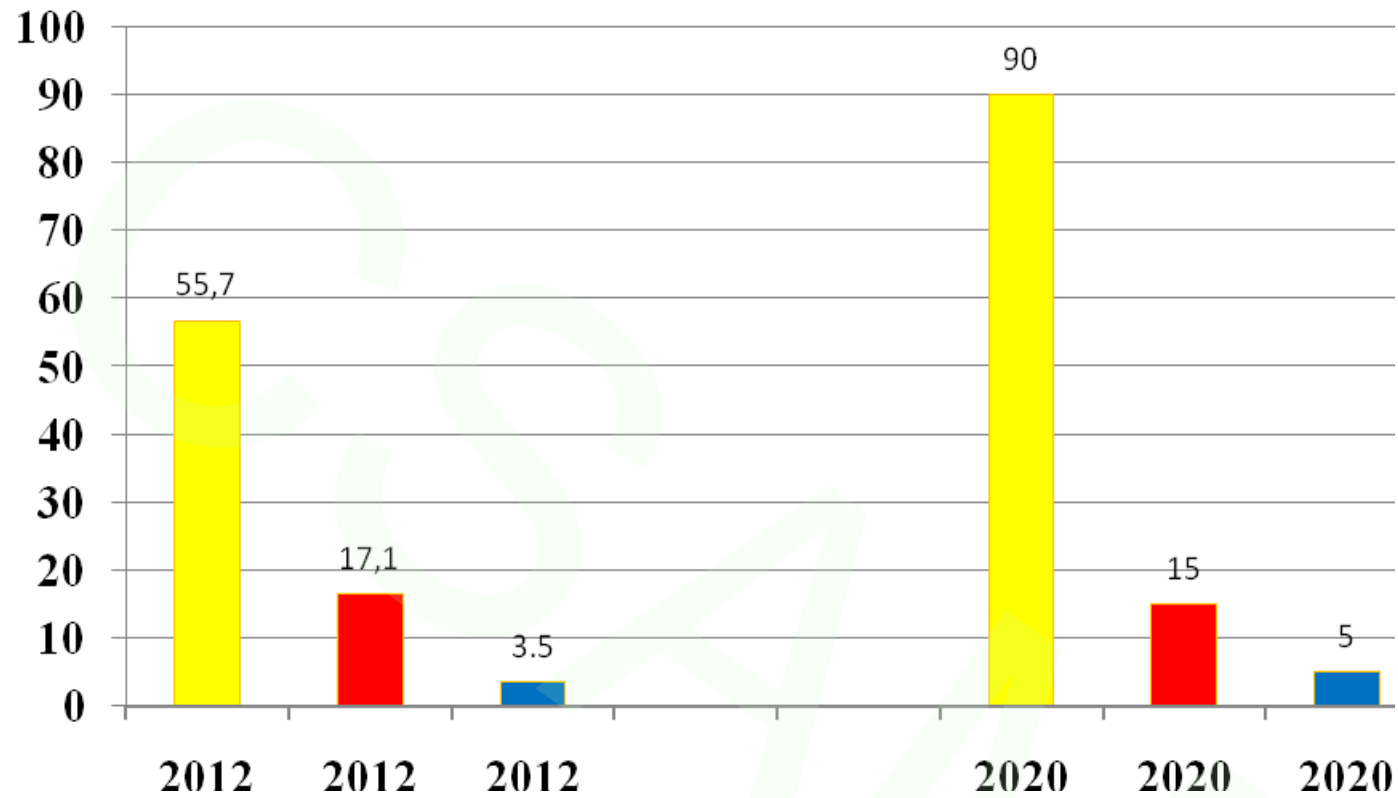
Types and numbers of Farms (thous. pieces)	Arable land, (million hectares)	Plants crops production, %				
		Grain	Sugar beet	Sun flower seeds	Potatoes	Vegetables
Enterprises (24,0)	55,7	76,8	87,6	72,4	13,5	17,1
People plots (17500)	3,5	1	0,4	0,5	78,9	69,1
Private farms (250)	17,1	22,2	12,0	27,1	8,0	13,8

**Cattle heads and animal production for 2012 \***

**Table 7.**

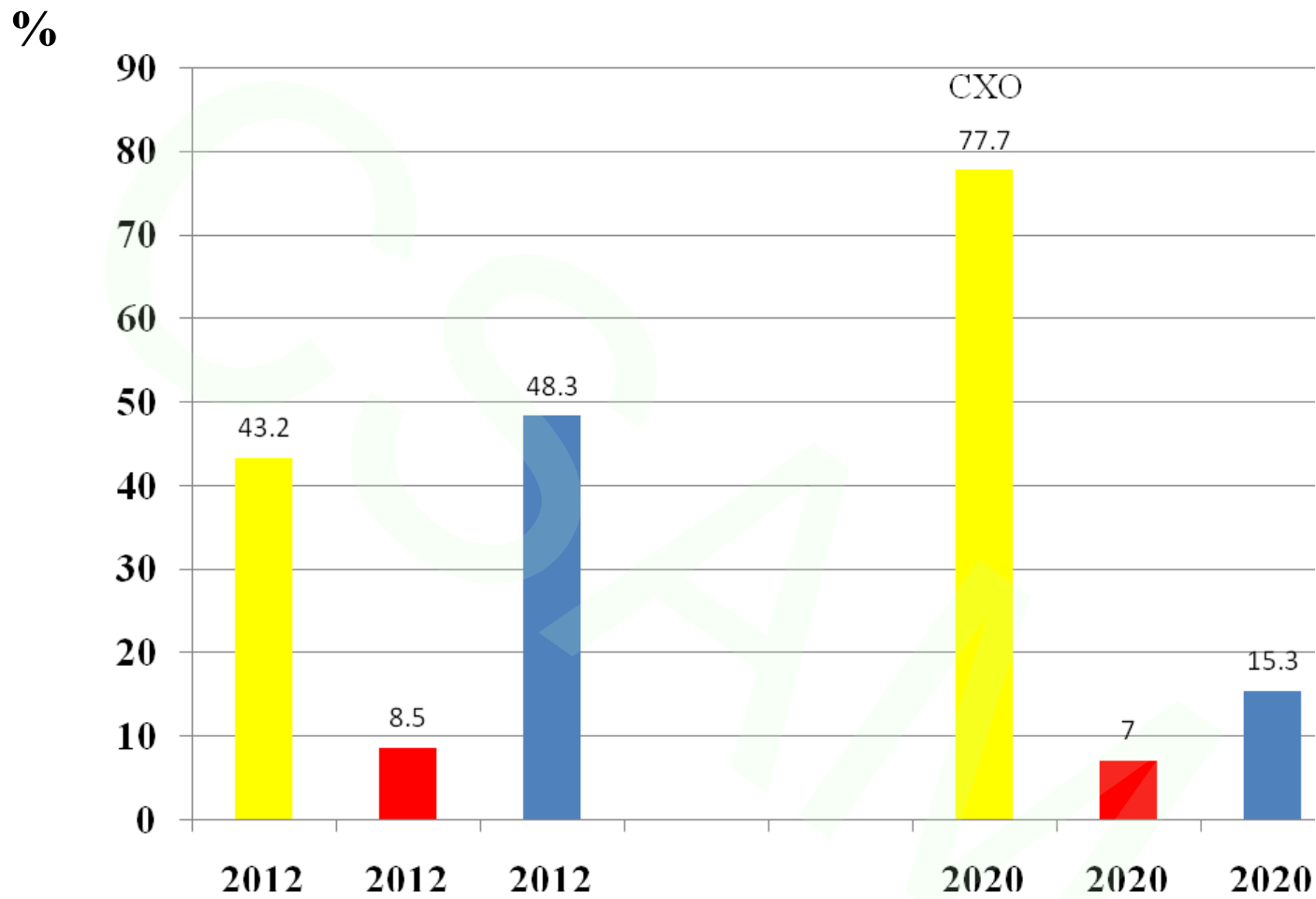
Types and Numbers of Farms (thousand pieces)	Cattle (animal heads), millions		Animal production (million pieces)		
	Cattle	Cows	Meat	Milk	Eggs
<b>Enterprises ( 24,0)</b>	<b>9,1</b>	<b>3,6</b>	<b>5,3</b>	<b>14,8</b>	<b>32700</b>
<b>People plots (17500)</b>	<b>9,0</b>	<b>4,3</b>	<b>2,5</b>	<b>15,4</b>	<b>8900</b>
<b>Private farms (250)</b>	<b>1,9</b>	<b>1,0</b>	<b>0,24</b>	<b>1,72</b>	<b>354</b>
<b>Total:</b>	<b>20,0</b>	<b>8,9</b>	<b>8,04</b>	<b>31,9</b>	<b>41954</b>

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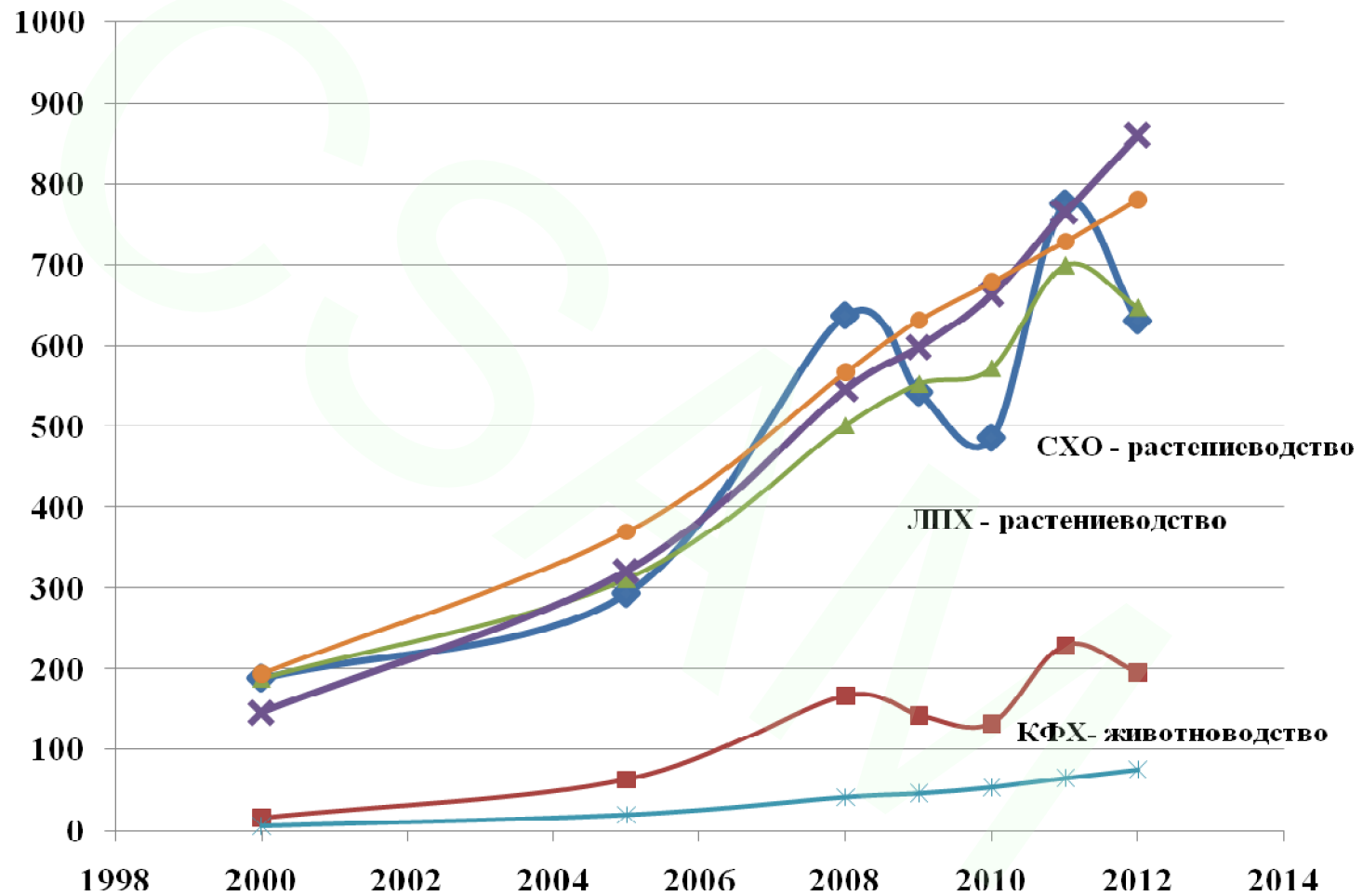
**Fig.1. Agricultural land resources in all types of farming for 2012 and prognosis of increasing for 2020.**

**Fig.2.Agricultural production for 2012 and prognosis on 2020, %**

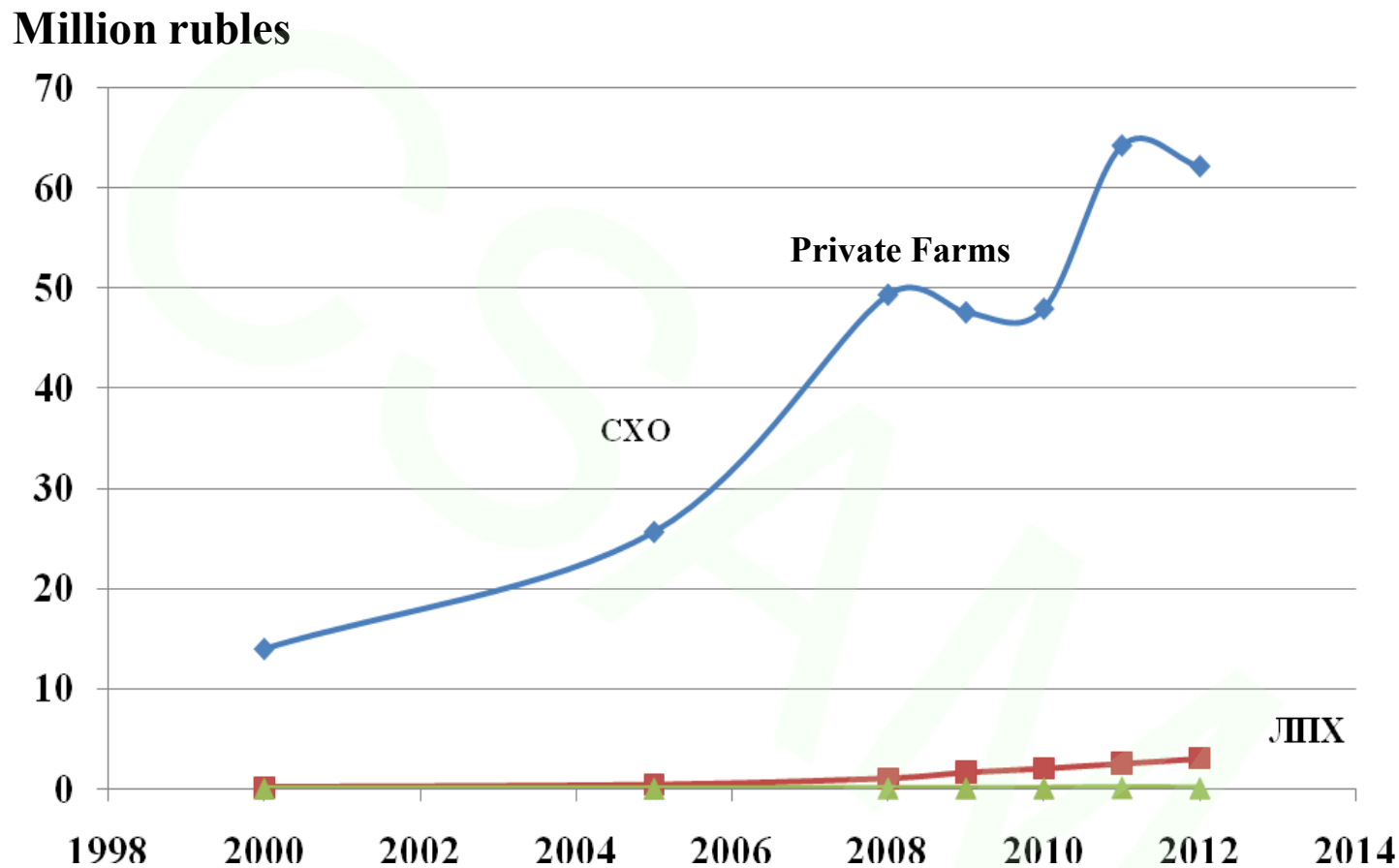


**Fig.3.Crops and animal production for 2000 – 2012 in real acting prices**

Billion \$



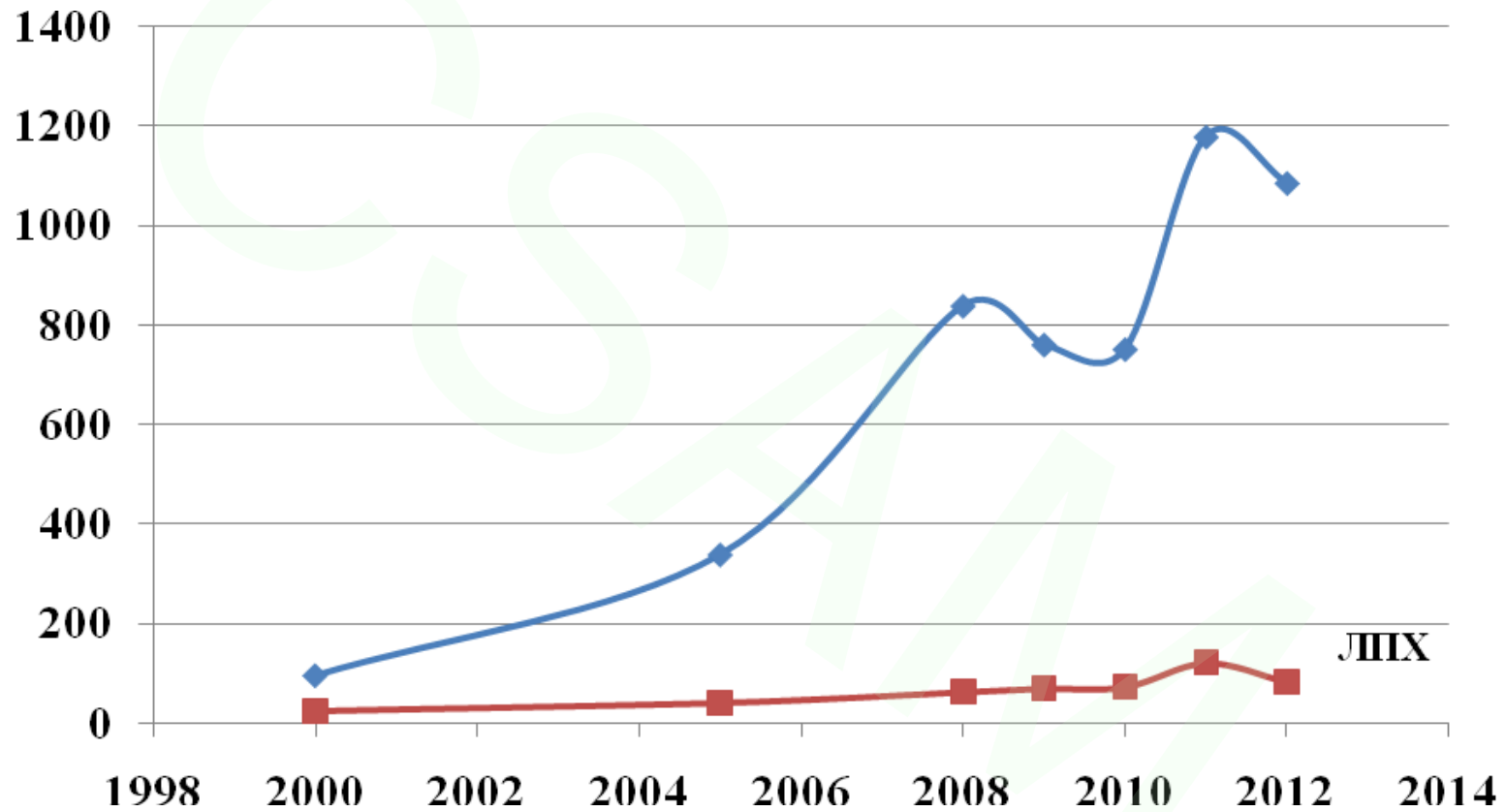
**Fig.4. Specific (for one farm) agricultural production, million. rubles  
in all types of farming for 2000- 2012**





**Fig.5. Specific (for one farm) agricultural production, thousand rubles  
in all types of farming for 2000- 2012**

**Thousand rubles.**



CSAM

## **New types of machinery for new forms of farming in Russia**

**Now we need to pay more attention to small type's tractors for private farms, population's plots, for gardening, selection, seeds and vegetables production. For this we prepared together with our Italian partners the special programs to organize the Joint venture for small tractors production, as follows': for gardening "BASE 20" of power 16kW, "ASTER 45" of power 32 kW, "ENERGY 80" of power 55 kW and others.**

**We also have special interest to small self-propelled crawler robot "Dargreen 45H" of French firm "DARIO" with engine power 33 kW, electric powered transmission and radio distant managing in radius up to 150 m which can have very wide specter of application in all types of Farms.**

**Self-propelled crawler robot “Dargreen 45H” of French firm “DARIO”**



## CONCLUSION

### **1.Strategy of support of the food security in Russian Federation.**

**1.1. To decide the problem of food security to 2020 the Russian Federation should first of all to start *a real innovative rehabilitation* of the industry on the base of high technological and technical levels in order to fill the machine-tractor fleet with the new machinery: 900 thous. tractors, 250 thous. grain harvesters, 60 thous. forage harvesters, 20 thous.units of sugar-beet harvesters and 30 thous.units of potato harvesters also many other machines (it will be enough for annually using of about 100 mln. hectares (from the total amount of 133 mln.ha of arable land). Also we need to improve 10-15 mln.ha of grasslands and pastures (totally we have ~20 mln. ha of the natural grasslands and ~ 60 mln.ha of the natural pastures);**

**1.2. However, the Russian Federation, in spite of the fact that there are the huge land resources, has tried to solve the food security problems by importing of more than 50% of food, above 70% of tractors, 40-50% of grain and forage harvesters, 95% of sugar-beet harvesters and many other agricultural machinery and equipment because of low domestic industrial, agro-technological and material-technical provision;**

## **2. The Main Energetic Indices of Technical Supplement of Russian Agriculture**

**2.1. The specific power per one hectare of arable land (kW/ha) including the total power of tractors, self-propelled harvesters and auto tracks used in Agriculture now is about 0,96 kW/ha. For tractor fleet only at the average power of one tractor 78 kW specific power is now about 0,4 kW/ha. It is not enough for successful Agriculture.**

**2.2 So, for the perspective fleet for 2020 a specific power of total fleet per one hectare of arable land (110 mln. Hectares) should be about 2,5 kW/ha but for the perspective tractor fleet only at the average power of one tractor 100 kW the specific power may be ~1,2 kW/ha.**

### **3. The most economical way to go out from critical situation in Russian Agriculture**

**3.1. For Russia it is absolutely necessary to increase *the domestic industrial production of the key machinery* not less than in 3,5-6 folds. Only this way can support the development of productive and competitive agriculture as exclusive measure for increasing *employment and income*;**

***THANK YOU FOR YOUR ATTENTION***

## **Some Proposals for Improvement of the Mechanization System in Russian Agriculture.**

**The Concept of the Universal Disengaged Power Units to save the farm material-technical resources and to renew of Agricultural Machine-Tractor Fleet in Russia-Belorussia Agriculture was realized in 1988-1996:**

**-designed, tested, and put under industrial production in Belorussia the Universal Power Unit multi-purpose UES-2-250/280“Polesie” (184...206 kW) with quickly-demountable high-effective harvesting adapters:**

- Rotary mower-crusher KPR-6 “Polesje” ;***
- Forage harvester complex K-G-6 “Polesje” ;***
- Grain harvester complex KZR-10“Polesje” Rotor”;***
- Sugar-beet harvester KSN-6 “Polesje” .***

**To the present time Belorussia produced ~ 10 000 complexes of machines on the base of UES-2-250/280 with 4 adapters and about 4500 complexes are working in 55 regions of Russia;**

**The Power Unit UES-2-250/280 “Polesje” has hydrostatic transmission and successfully works with some agricultural machines (tractive force up to 20 kN) mostly with active working tools and also can be used in forestry and communal branches of economy.**



## The effective harvesting complexes on base of Universal Power Unit “UES-2-250A "Polesje” of power 250-280 HP (184...206 kW)



***Forage harvester complex K-G-6 “Polesje”***  
with chopper and adapters for cutting green grasses, haylage and silage from grasses and corn.  
***-productivity up to 90 t/hr***



***Rotary mower-crusher KPR-6 “Polesje”***  
with demountable conditioners for crushing of grasses and stacking two swaths.  
***- productivity up to 6 hectare/hr***

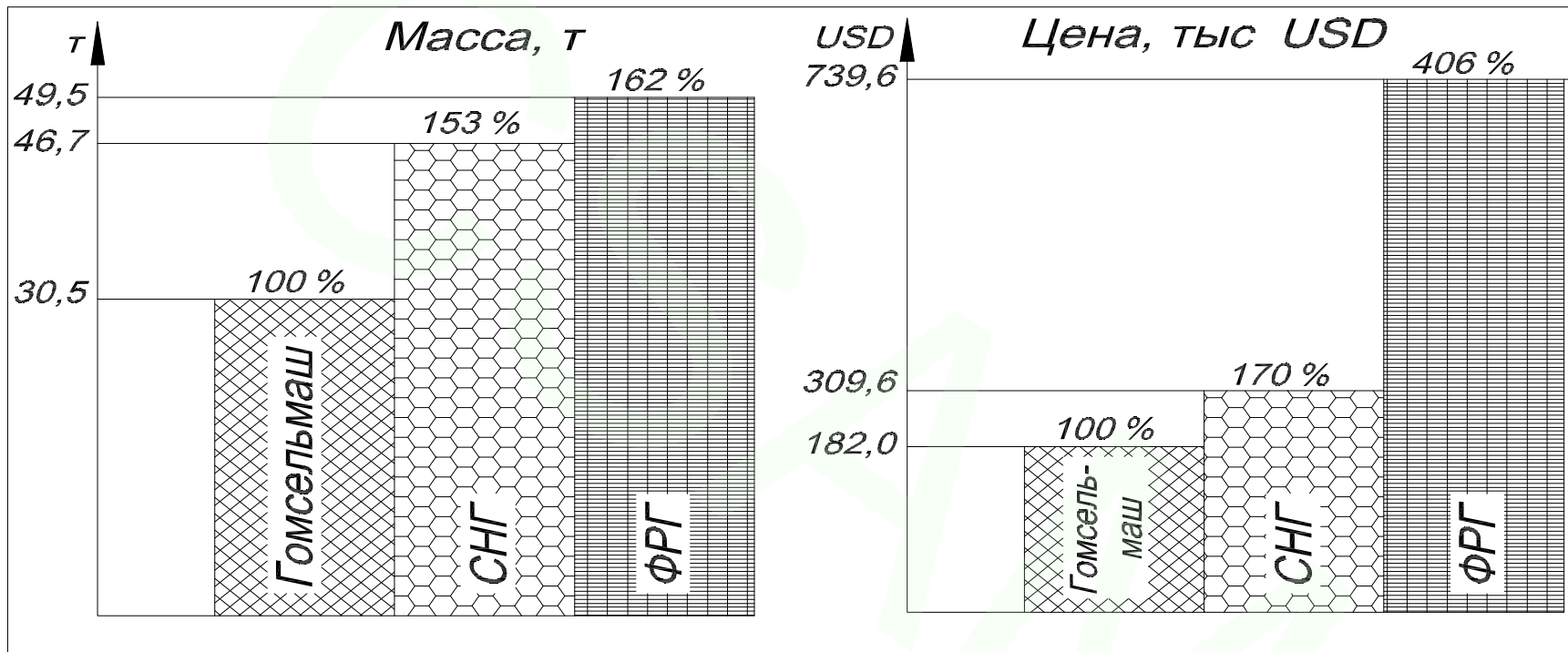


***Sugar-beet harvester KSN-6 “Polesje”***  
for one pass cuts tops, digs out, cleans and stacks roots in a row between wheels of power unit.  
***- productivity up to 2 hectare/hr***



***Grain harvester complex KZR-10“Polesje” Rotor”***  
with front mounted header and axial rotary thresh drum-separator also fastened behind to UES by the block of air-cleaning with a grain bunker.  
***- productivity on a grain up to 20 t/hr***

**Main indices of efficiency of harvesting complexes on the base of UES-2-250A “Polesje” for forages, grain, sugar-beet, grasses for hay and haylage**



**Saving Mass in USD at least 16...20 tones of construction materials**

**Saving Price in USD at least of 127 000 \$**

## **New concept of powerful universal energetic unit UES-290/450 with double flow hydro-mechanical transmission and engines of 290-450HP**

**1. Taking into account the experience of decade's application in Agriculture of Russian Federation, Belorussia, Ukraine, Kazakhstan and some other countries the complexes of UES-2-250/280 "Polesje" there were worked out the perspective machines on the base of more powerful UES-450 with engines of 290...450 HP (213...330 kW);**

**2. Complexes includes 8 new machines and adapters on the base of UES-450 and they were designed, tested and recommended for industrial production in a frame of realization of the Russian-Belorussian Program of State Union in 2006-2009;**

**3. The difference between two concepts consist of in replacement of hydrostatic transmission of UES -2-250A "Polesje" (tractive force ~ 20 kN) by the new type of double flow hydro-mechanical transmission which allows UES-450 successfully works not only with harvesting machines driven by PTO but also with plows, drills, tools and tillage-sowing aggregates which need the high tractive forces ~50...60kN;**

**4. UES-450 also can successfully work with different agricultural machines and implements which are now under industrial production in Russia, Belorussia also with some domestic and imported combined tillage and sowing aggregates which allow to fulfill 4-5 technological operations for one pass of Machine-Tractor aggregates. It can be used practically all year round;**

**5. The most efficient to use UES-450 (engine power 350 or 450 HP) with harvesting adapters instead of self-propelled harvesters, powerful and heavy tractors also to use UES-450 with efficient combined agricultural machinery.**

## **HARVESTING COMPLEX ON THE BASE OF UES-450**



**Mower-conditioner KPR-9**



**Grain Harvester KZR-12**



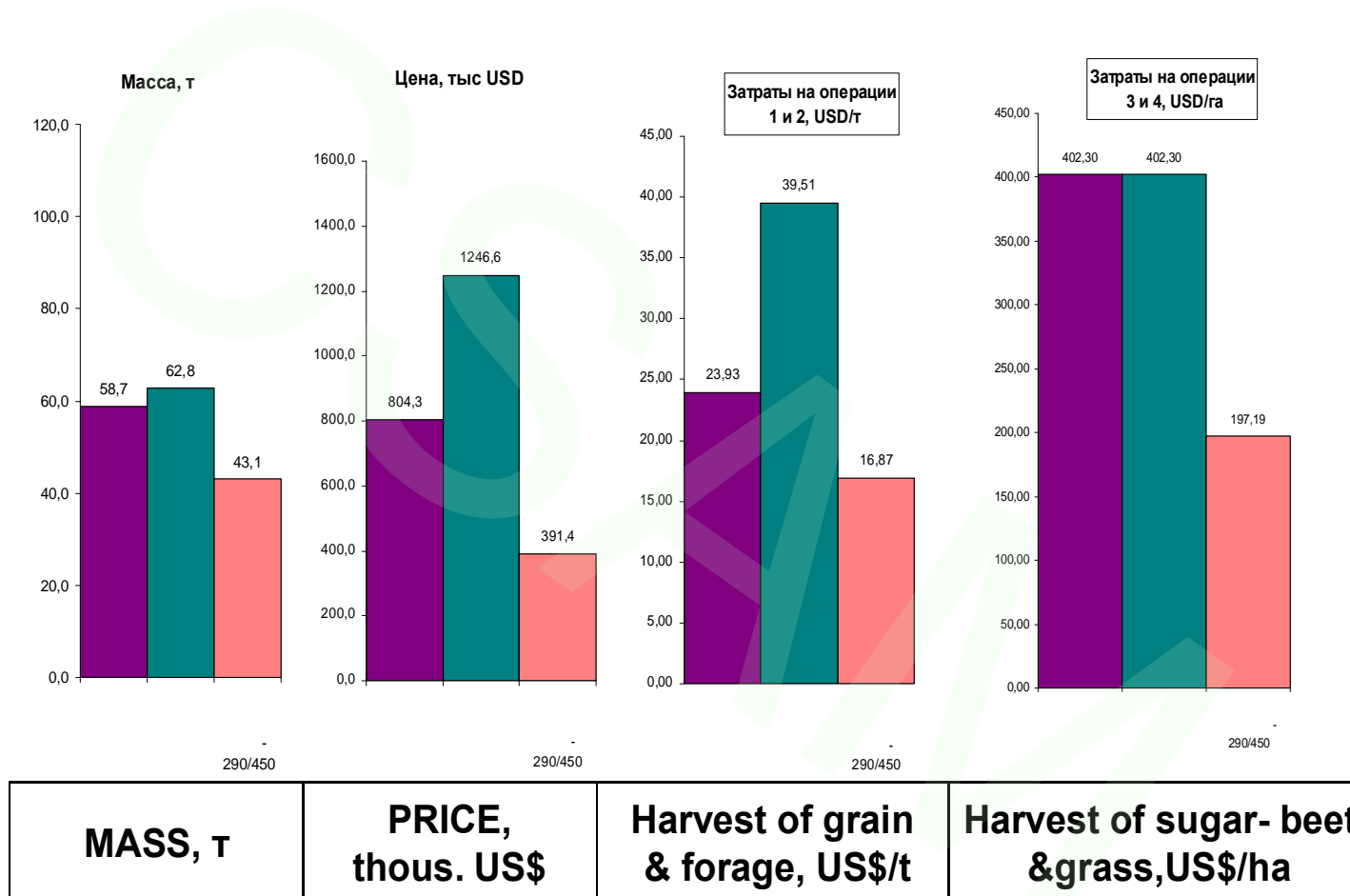
**Forage Harvester KNK - 500**



**Sugar-beet Harvester ASU-6**

Fig.19

## EFFICIENCY OF 4 HARVESTING MACHINES on the base of UES-450



## Tillage and sowing machines on the base of UES-450



**Reversible plow**



**Heavy disc harrow**



**Rototiller**



**Rotary chisel plow  
for depth of 45-50 cm**

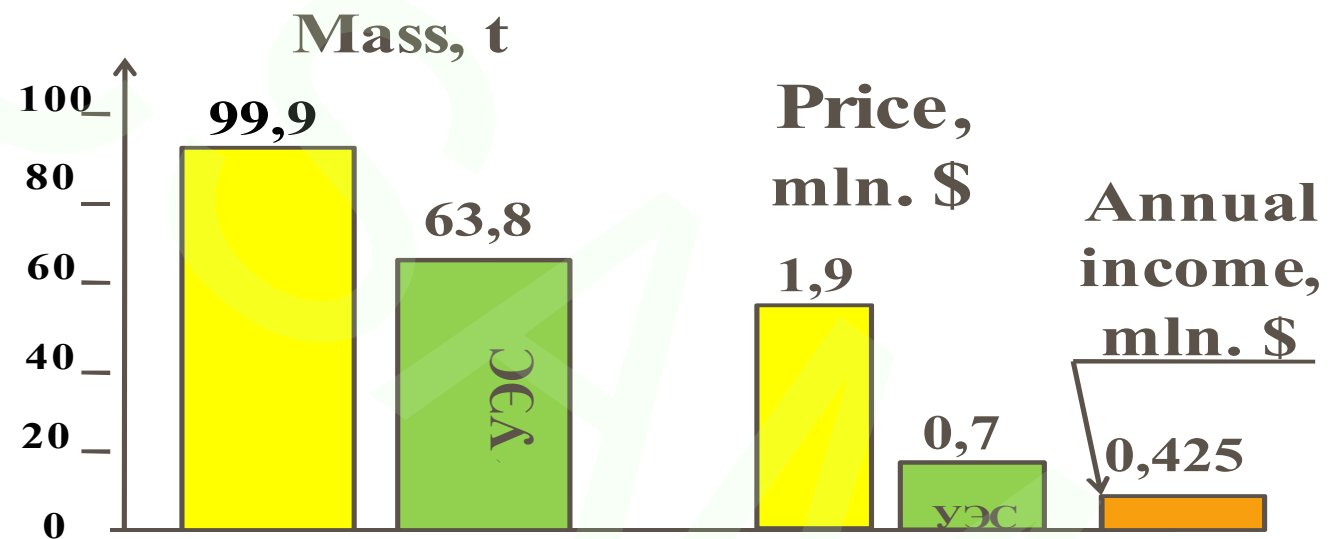


**Combined aggregate  
for tillage & sowing**



**Combined aggregate  
“Vaderstad” (Sweden)**

**Efficiency of complex of 8 machines on the base of UES-450 in comparison with CIS countries' machines**



**Total annual income for one complex of machines on base UES-450 is about 0,425 mln. \$**

# System of universal mobile power units: UES-60/100; UES-120/200; UES-210/280; UES-290/450; UES-500/700 (interval of power, HP)

